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The

FORD TEN AND PREFECT HANDBOOK

STATON ABBEY

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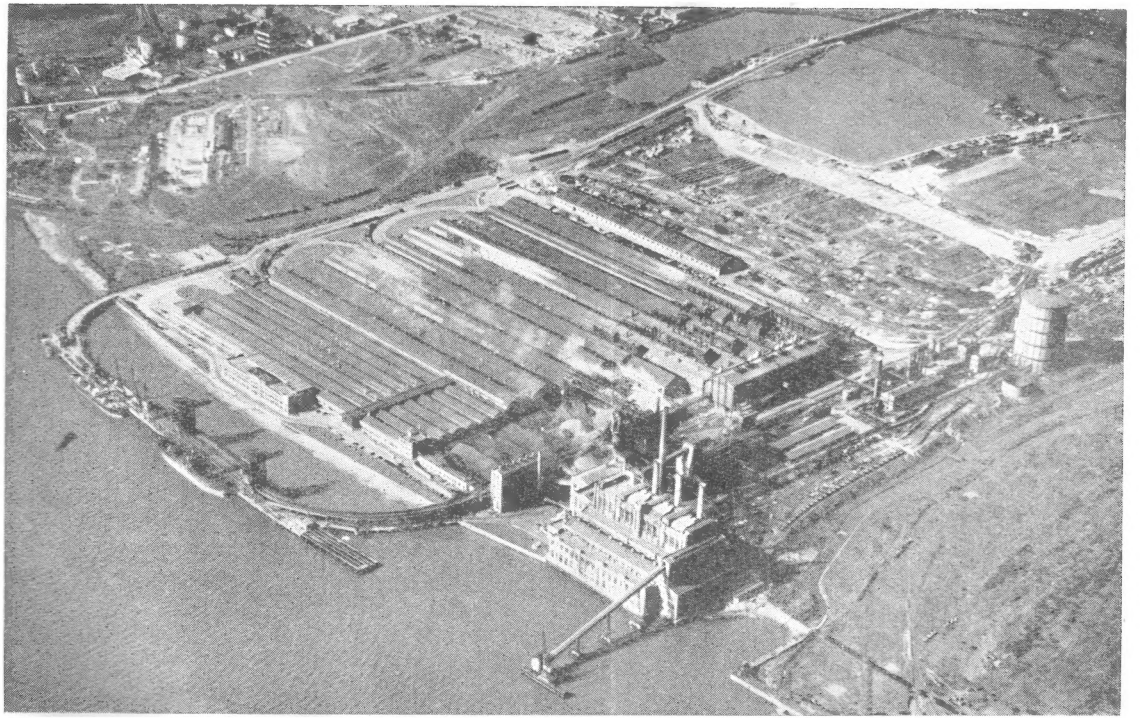

AN AERIAL VIEW OF THE FORD WORKS, DAGENHAM, ESSEX

Standing on a 600-acre estate of reclaimed marshland, the main assembly building alone covers over 32 acres—all under one roof

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The
FORD TEN AND PREFECT HANDBOOK

A PRACTICAL HANDBOOK COVERING ALL
10 H.P. MODELS EXCEPT
THE NEW PREFECT INTRODUCED IN 1953

BY
STATON ABBEY

AUTHOR OF

"*Automobile Workshop Practice*," "*Automobile Fault Tracing*," "*Automobile Transmission Overhaul*," "*Automobile Chassis Maintenance and Overhaul*," etc.

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PREFACE

UNTIL the introduction of the New Prefect, which was first announced in October, 1953, there had been few major changes in the succession of 10 h.p. models, many of which earned the respect and affection of their owners under the names "Prefect," "De Luxe Ford" and "Ford Ten." Although the name "Prefect" was retained, the new models represented such a radical change in chassis and body design that it was no longer feasible to include the latest cars in this book.

Where all the previous models were concerned, however, the changes that were made from time to time did not affect the very close family resemblance between successive models in the range. As the result of this policy of detail improvement from year to year, a policy that the Ford Motor Company has proved to pay ample dividends in the form of reliability, performance and economy of first cost and of operation, it has been possible to cover the complete range of earlier 10 h.p. models fairly comprehensively, even in a book of this modest size.

The present edition has been brought up to date, a considerable amount of new material being incorporated during the process.

The Ford Motor Company, although in no way responsible for the publication of this book, has been most helpful in supplying information and illustrations. As it is the practically-minded owner who is most often likely to devise methods of carrying out work with limited equipment, however, I should be grateful for any first-hand hints and tips which may be worth passing on to other owners in subsequent editions; criticisms, too, will be welcome if they enable the book to be improved.

STATON ABBEY

ST. OSYTH
ESSEX

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CHAPTER I

ON THE ROAD

Now that driving tests are compulsory for holders of new licences, this chapter has been made as complete as possible so that the beginner will know exactly what to do, how to do it, and when to do it.[1] It will also be necessary for new licence-holders to have a knowledge of the new Highway Code, a copy of which should be obtained and the various points noted.

The Controls. First, you must be perfectly familiar with all the controls, and the best way in which this can be done is for you to place yourself in the driver's seat and look at the controls, dials, etc. Let us start with the *carburettor starting control*, which is operated by pulling the knob out and turning it in a clockwise direction. This knob should be left out until the engine has warmed up and then released by turning in an anti-clockwise direction. Do not pull out this knob when the engine is warm.

Next comes the *lighting* and *ignition switch*. The ignition is turned on by inserting the key and turning it in an anti-clockwise direction. Do not leave the ignition switched on when the engine is not running, because if this is done the battery may be completely discharged and it will be impossible to start until the battery has had a charge from an independent source. The lighting switch is the black object in the centre of which the ignition key is inserted. The wing and tail lamps are on when the switch is turned in an anti-clockwise direction, off in a vertical position, and the wing, head, and tail lamps are on when it is turned in a clockwise direction.

Next comes the *starting motor control*; this is operated by pulling the knob out and releasing it as soon as the engine fires. If the engine does not start immediately, release the knob and then give it another pull. Don't, please don't, sit in the car and hold the knob out until the battery has run dry, but rather find out what is wrong (see page 32).

We come next to the first dial, which is the *ammeter*. Turn the ignition key to the "on" position and watch the sensitive pointer move. This pointer indicates "charge" when the generator is charging the battery, and also registers the current used for lighting and ignition. The average charging rate should not

[1] *Your Driving Test: How to Pass It* (Stewart). Pitman.

exceed 10 amperes, and should the pointer show a reading above this you should turn to page 52 or consult a Ford dealer. If the engine is running above 15 m.p.h. (top gear), and the pointer does not register "charge" when the lights are "off," also turn to page 52 or see a Ford dealer. On recent Tens fitted with automatic control of the charging rate, however, the charging current varies with the state of charge of the battery; it may be as high as 30

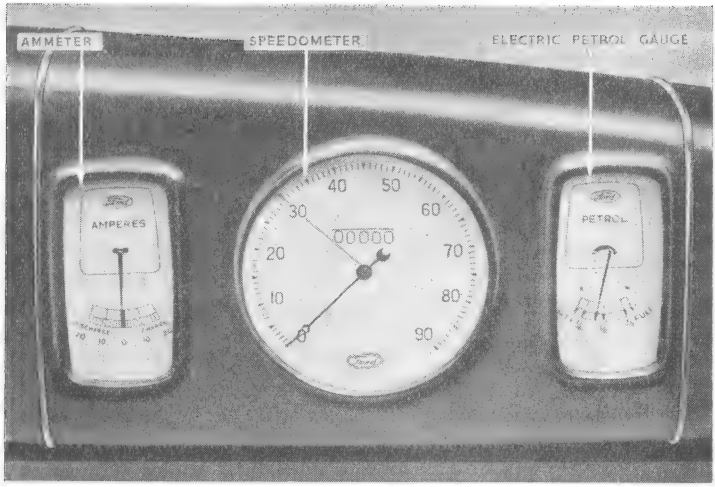


FIG. 1. SHOWING THE VERY NEAT DASHBOARD ARRANGEMENT ON EARLIER MODELS

amperes when the battery is discharged, falling to 3 amperes with a fully-charged battery.

The next dial is the largest of the three and will be recognized as the *speedometer*. This registers the speed at which the car is travelling and the mileage covered. You will notice that the dial reads up to 90 m.p.h., but do not be misled by this and think you are going to get "90" out of your car, because you will be disappointed. It is quite possible that you will have the satisfaction of attaining a speedometer reading of 75 m.p.h. from your Ford, and you will be surprised at its road-holding capabilities at this speed. Although an occasional burst of speed is quite in order, not even a Ford will stand up to long distances all out. We now return to the remaining dial, which is the *electric petrol gauge*. Do not forget that the gauge only registers when the

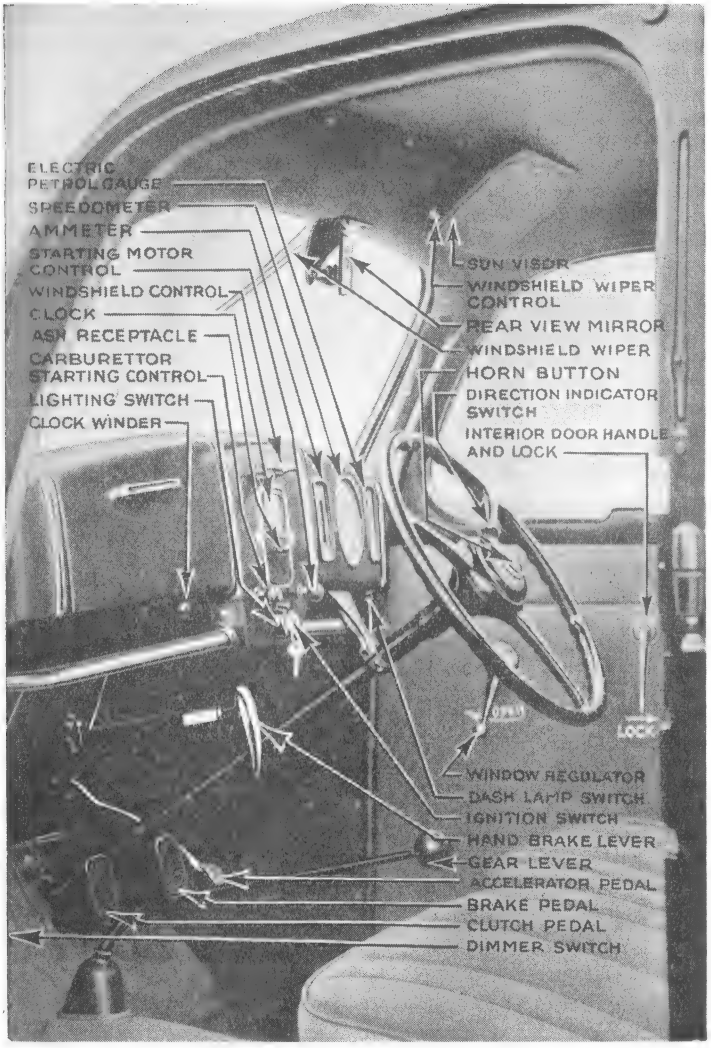


FIG. 2. THE CONTROLS OF THE EARLIER TENS

ignition key is turned on, otherwise you may be ordering petrol which the tank cannot hold, with disastrous results.

The *dash lamp switch* controls the indirect illumination of the instruments. There is one other control to be explained, and that is the *windscreen control.* This is operated by turning the "wing" control in a clockwise direction, but make sure that your vision is not impaired by the bottom part of the frame.

Now turn to Fig. 2, which shows firstly the *mirror.* This can be moved to any position and you should get this set in such a way that you can see following traffic without having to stretch your neck, an error which one occasionally sees some drivers commit. Although the clock face appears in the centre of the mirror (De Luxe Models) no inconvenience will be caused providing the mirror is correctly adjusted for rear vision. If you are a mere male make sure your wife has not shifted its position in order to powder her nose, when you have popped out to make a purchase or for any other reason.

On the right of the mirror on earlier cars will be seen a bright stud which is the *windscreen wiper control.* Recent cars have a control on the dashboard marked "W." The wipers are put into motion by pulling the stud out, and will only operate when the engine is running as they are of the suction type. When you have cause to put these wipers into action take care not to accelerate too suddenly, as the wipers will stop until you release the accelerator pedal slightly, but later models have a vacuum reserve tank which overcomes this difficulty.

A small black knob will be seen in the centre of the steering column. This is the *horn button* and is operated by pressing (see page 15 regarding when not to use the horn).

The rear handle you see fixed in the door is the *interior door handle.* When the door is closed it can be locked by moving the handle in a backward direction. To open the door from this position move the handle forward.

Another control fixed in the door is the *window regulator.* To open the window the handle should be turned in a clockwise direction.

Next comes the *dimmer switch.* This can be plainly seen protruding through the floorboards, where it may be conveniently operated by the left foot. Depressing the switch button changes the headlamp beam from normal to dipped, while depressing it again brings the beam back to normal. The *handbrake lever* controls the brakes on the rear wheels only, and this lever is primarily used for parking and in emergencies. To put the brake on pull the lever back as far as it will go, and to release it give it a pull backward and close the hand, releasing the ratchet, when the lever may be pushed right forward to the off position. Always make sure you have pushed it as far forward as it will go.

The next control is operated by the left foot and is the *clutch* pedal. When this pedal is depressed the drive between the engine and the gearbox is disconnected, thus enabling one to change gear or bring the car to a halt. Your attention is directed to the fact that you should avoid driving with your foot resting on this pedal. The foot should be kept close to the pedal, not on it, except when gear-changing and pulling up. If this rule is not observed excessive wear of the clutch parts will result and frequent adjustment will become necessary. Probably the clutch

FIG. 3. SHOWING HOW THE WINDSCREEN IS OPENED

disk will have to be refaced earlier than would normally be the case. More will be said about use of the clutch later.

The *gear lever* is the next control to be dealt with. This lever permits the selection of the gear required. Whenever starting the engine make certain that the gear is in neutral. The four positions of the gear lever are shown in Fig. 4, and you will be well advised to study this diagram and memorize the different positions. A great point to remember is that you must *not* look down when making a gear change. Besides being quite unnecessary, it is an extremely dangerous practice.

The *direction indicator switch* is situated on top of the steering column or on the gear lever and in the former case is of the self-cancelling type. When the switch is moved to the left or right, respectively, the near or off-side direction indicator arm rises to the horizontal position. The signal cannot be operated until the ignition is turned to the "on" position.

Next comes the *footbrake* pedal. This works on all four wheels and is extremely powerful yet smooth in action.

The last control to be described is the *accelerator* pedal. This control regulates the supply of petrol gas to the cylinders and thereby the speed and power of the engine. It works with immediate effect and any heavy sudden acceleration or deceleration of the engine has to be transmitted to the car in the form of less or extra speed, and is bound to cause a strain on the clutch and other parts of the transmission.

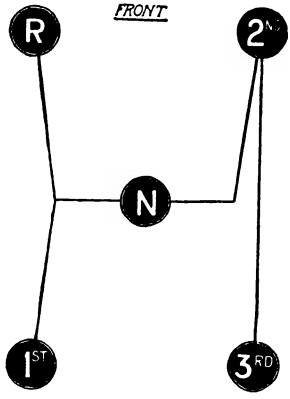


FIG. 4. SHOWING THE GEAR POSITIONS

Filling-up. First see that the radiator has sufficient water (rain-water is preferable), the correct level being within 1½ in. of the filling orifice. Then make sure that there is sufficient petrol in the tank. Also see that the battery contains the correct quantity of acid and is properly charged, and that the tyres are inflated to the correct pressure (see page 82). The petrol tank, the filler cap for which is situated at the rear of the car, holds 6½ or 7 gallons. Make sure that the engine, gearbox, clutch chamber, and differential case are supplied with the correct amount of oil (also the correct grade, see page 32).

Starting-up. First see that the gear lever is in neutral. If the engine is cold pull out the choke knob (see Fig. 2) as far as it will come and turn it to the right where it will stay until released. Depress the clutch, switch on the ignition, and as soon as the engine fires push back the starter control. The starter control should be released immediately, since the starter should not be left in action while the engine is running, or damage may be done. Then release the clutch gradually (to prevent stalling the engine on account of oil drag in the gearbox), and release the choke knob gradually as soon as the engine begins to run erratically due to the rich mixture. When the engine is warm it is quite unnecessary to use the choke knob and in fact it is harmful to do so.

Having got the engine running slowly press the accelerator pedal and get the "feel" of the engine. It is as well to state here that the accelerator pedal spring is very easily depressed, and only slight pressure is necessary to get the engine turning over at the correct speed in order to "take off" without a nasty jerk.

Driving off. Having got the engine turning over at the correct speed, slowly press the clutch pedal down (the left-hand pedal) and then engage low or first gear (to the left and backwards, see Fig. 4). Do not force the gear in; it should engage quite easily and without force of any kind. Now release the handbrake and let the clutch come up gradually, at the same time increasing the speed of the engine by gently pressing the accelerator pedal. The car should now be moving smoothly away. The beginner will probably find that he either stops the engine or starts off with a jerk. This is caused by letting the clutch in too quickly, and should be rectified at an early stage, as enormous strains are placed upon the transmission, and it is also bad for the engine.

After having travelled some few yards the driver should attempt to change into second gear. (The road speed will be in the neighbourhood of 10 m.p.h.) To do this, again press the clutch pedal down, bring the gear lever into neutral position, then move the lever to the right and forward which will engage second speed gear, then release the clutch. The change to top or third is more simple and should be made fairly quickly. Put out the clutch and pull the gear lever straight back towards you and then release the clutch. You are now in top and doing famously, but don't take any liberties yet.

Reverse gear is obtained by putting out the clutch and moving the gear lever (from neutral) to the left and forward.

Gear changing will now be explained in greater detail.

Changing-up

Move gear lever to the required position.

Very gradually ease the pressure on the clutch pedal and place the foot lightly on the accelerator pedal, *increasing* the pressure on the accelerator pedal as you *decrease* the pressure on the clutch pedal.

When the speedometer reading is approximately 10 m.p.h. in first gear, remove the foot from the accelerator pedal, push the clutch pedal right down, and move the gear lever forward to the right and again forward. Now take your foot off the clutch pedal and place your other foot back on the accelerator pedal.

When the speedometer reading is approximately 17 m.p.h. remove the foot from the accelerator pedal, push the clutch pedal right down and pull the lever backwards, i.e. towards you. Now let the clutch pedal come up; at the same time put slight pressure on the accelerator pedal.

The speed of the car is now controlled by the accelerator pedal. Remember to keep the speed down to 30 m.p.h. in top until the engine is run-in (see page 18).

FIG. 5. THE LUGGAGE COMPARTMENT OF THE TEN

CHANGING-DOWN

First press the clutch pedal down but keep the foot on the accelerator pedal in order to bring the speed of the engine up to the speed the car is travelling. (When making a change at high speed increase the pressure on the accelerator pedal.)

Now move the gear lever straight forward, hesitating slightly before pushing it right home. Release the clutch pedal and at the same time place pressure on the accelerator pedal.

When changing from second to first gear, the clutch pedal should be pressed right down and the accelerator pedal released. Now put the gear lever into the neutral position and release the clutch pedal. Pressure should be placed on the accelerator pedal (quick action this) and then released. Now press the clutch pedal right down and move the gear lever to the left and backwards. Release the clutch pedal and control the speed of the car with the accelerator pedal.

REVERSING

Before attempting to reverse, the car *must* be brought to a standstill. With the foot off the accelerator pedal push the clutch down, and move the gear lever to the reverse position (see Fig. 4). Now *decrease* the pressure on the clutch pedal at the same time *increasing* the pressure on the accelerator pedal.

Always look over the left shoulder when reversing and always remember never to change the direction of travel before first coming to a standstill.

A Few Hints on Gear-changing. If you have bungled the gear change and cannot get into the desired position, don't lose your temper and try to force the lever into position. Stop the car by pressing the left and right pedals, put the gear lever back into the neutral position, and start from the beginning. Not only will this save the gears from being damaged, it will also give you additional practice. Remember the old saying: "Practice Makes Perfect," and you will realize you are not wasting time.

Never try to engage a "forward" speed while travelling backwards or, vice versa, reverse while travelling forwards. Always make certain the car is stationary before engaging a gear which will reverse the direction of travel.

When changing to a higher gear the left (clutch) pedal must always be pushed right down and the foot removed from the right (accelerator) pedal until the change has been made.

Running-in New Engines. After buying a brand new Ford special caution must be exercised for a certain period of driving in order to allow all moving parts to become bedded down and bearing surfaces to harden. Any attempt to expedite matters

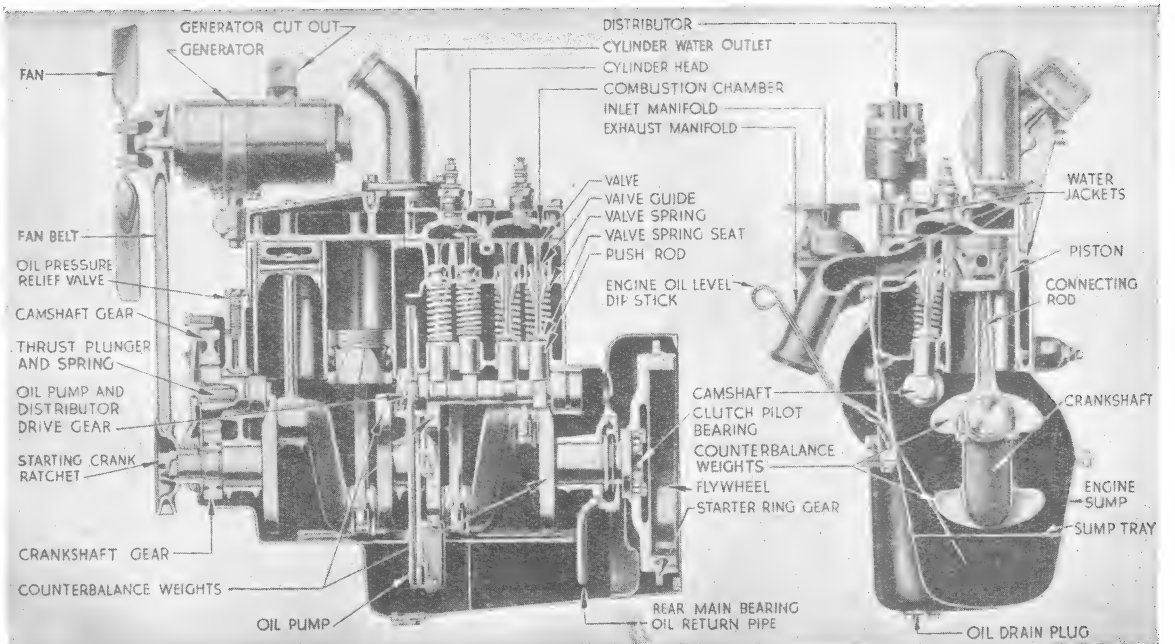


FIG. 6. SECTIONAL AND END VIEW OF THE ENGINE

is doomed to failure and may permanently spoil the engine. Until 500 miles have been covered, a speed in excess of 30 m.p.h. in top gear should not be attained, and large throttle openings should not be used.

As described in Chapter III, new engines should be given frequent attention during the first 500 miles if they are to give long and trouble-free service. The cylinder head stud nuts should be gone over to see that they are all quite tight. The oil should be drained and the engine refilled with fresh oil after the first 300 miles have been covered.

Proper Use of Brakes. It is the fault of many drivers to "drive on the brakes," that is, to apply the brakes vigorously and often in a somewhat erratic manner. This is very bad practice, as not only are the brake linings quickly worn away in consequence but also the life of the tyres and the transmission system generally is considerably shortened.

The expert allows the engine to act as a brake, when a gentler retardation is effected and skidding risks minimized.

A change to second gear when approaching a severe bend will slow the car appreciably, so that a violent application of the foot-brake is unnecessary.

Likewise the descent of lengthy and severe gradients should be made on a lower gear; if second or first gear is used it is often possible to descend an extremely severe hill without even touching the brakes. This practice is not detrimental to the engine in any way.

During the autumn and winter weather the roads are often exceedingly treacherous, due either to decaying leaves on the surface, or to greasiness as a result of morning frost and mist. At such times especially, violent application of the brakes should be avoided, thus neutralizing, as far as possible, the probability of a skid.

To change from top to second on a Ford is extremely simple, and if the driver is approaching a bend of any severity it is an easy matter to engage the lower ratio before the bend is reached. One can then accelerate round the bend, a safer method than rounding it on the over-run. Moreover, one has at one's command the extra engine power for increased speed or retardation essential for coping with emergencies. Negotiated in this manner the corner is taken with a minimum of risk.

Furthermore, all braking should be carried out as far as possible when the car is travelling in a straight line. The possibility of a skid is reduced if this is done.

CHAPTER II

THE MOTORIST AND THE LAW

Abandoned Cars. Where a car has been stolen and subsequently abandoned, the cost of removing the car from the highway must be borne by the owner, and the police have power to recover any cost incurred for this service.

Accident Procedure. If when on the road a motorist is concerned in an accident whereby damage or injury is caused to any person, vehicle, or animal (including a horse, cattle, mule, sheep, pig, goat, or dog) the driver must stop and, if required so to do by any person having reasonable grounds for so requiring, give his name and address and also the identification marks of the car. If such details are not given at the time of the accident the driver must within twenty-four hours report the accident at a police station or to a police officer.

When involved in an accident requiring medical assistance, the driver should do everything possible to render aid to those injured.

It is advisable to give to those concerned only essential details, and not to make any statement which may afterwards have a detrimental effect on your own position and also on that of the insurance company.

If possible, secure the names of likely witnesses of the accident so that your legal advisers and insurance company can take all steps necessary to protect your interests.

Braking Tests. The Ministry of Transport has introduced a regulation (1st May, 1937) giving the police power to test the brakes of cars. Brakes may be tested *with the owner's consent* in a garage, but 48 hours' notice must be given. The notice does not apply in the case of a vehicle which has been involved in an accident within the previous 48 hours. The same applies in regard to the testing of steering gears and silencers.

Driver's Age and Fitness. The minimum age at which a person may drive a motor-car is seventeen, and every applicant for a driving licence must make a declaration as to whether or not he is suffering from any disease or physical disability which would be likely to cause his driving of a motor vehicle to be a source of danger to the public. Extremely bad sight or liability to fits of an incapacitating nature are disabilities that would prohibit the issue of a driving licence.

Driving Licence. For a licence to drive a motor-car, application must be made to the offices of the town or county council in which

the applicant resides. When the form of application has been completed it should be forwarded to the council with the fee of five shillings which licenses the driver for twelve months from the date of issue. The licence can be obtained either personally or by post, and is not transferable. In the event of the original licence being lost a fee of one shilling is charged for the issue of a duplicate licence.

Immediately on receipt of the licence the holder must sign it before taking the car on the road.

On the expiration of the licence application for renewal must be made by the holder, as notice of expiry is not always given by the authorities.

Driving Test. A driving test is provided for in the case of all new holders of driving licences, but this regulation does not apply to a person who is exempted under certain conditions. The form of the test includes such matters as examination in the Highway Code; starting a car, overtaking and backing the car within a limited space. The holder of a provisional licence must make an application to be tested during the period of the licence.

Driving Under Influence of Drink or Drugs. If when driving, or attempting to drive, or in charge of a motor vehicle any person is under the influence of drink or a drug so as to render him incapable of having proper control of the vehicle, he is liable to heavy penalties of fine or imprisonment, or to both fine and imprisonment. Disqualification from holding a licence for twelve months may be imposed if the Court thinks fit.

Endorsement of Licence. On conviction of a motorist for a road offence an order is sometimes made for the nature of the offence to be endorsed on the licence. Details of endorsements are also sent to the authorities granting the licence, but, if the holder has a good driving record for three years from the date of the last endorsement, the offences are not recorded on any new licence issued. It is not permissible for a police officer to take notes of any endorsement.

Highway Code. All motorists should secure a copy of the latest edition of the Highway Code, the official publication issued by the Minister of Transport for the guidance of road users. It can be obtained from H.M. Stationery Office or through any bookseller, and the price is one penny. Among the useful hints given are those on speed, signals, overtaking, corners and bends, cross roads and road junctions, and white lines. The Code also fully explains the signals that every motorist should know—those to be given by the motorist, and those to be given by police constables and others engaged in the regulation of traffic.

Identification Plates. If the number plate is in any way obscured or not easily distinguishable, improperly illuminated, or not

properly fixed, the driver is guilty of an offence. Care must also be taken to see that such plates conform with the regulations as to size and arrangement. To check the arrangements on a second-hand car, see S.I. 1618 (1949) Regulation 21.

Inspection of Licence and Insurance Certificate. Without assigning any reason for his action, a police officer may stop any person driving a car and call for the production of the driving licence and certificate of insurance. Provided the documents are produced at the police station named within five days, the driver will not be convicted of an offence for non-production when first stopped by the police officer.

Insurance. It is compulsory for every motorist to take out an insurance policy. Although the law is satisfied with a third-party policy a comprehensive policy is recommended.

Lighting. The lighting arrangement for each car is dealt with by the manufacturers in such a way as to comply with the law, so that the motorist's chief concern is to see that the same system is maintained during his ownership of the car. In the event of damage to the car those responsible for the repair work will see that the lamps are replaced in the same positions as they originally occupied before being damaged. (See page 57.)

Lighting Regulations. All motor vehicles must comply with the Ministry of Transport Lighting Regulation. The most important clause deals with that bugbear of all night-driving motorists, dazzle.

No lamp showing a light to the front shall be used unless such lamp is so constructed and fitted to the vehicle that the beam of light emitted therefrom—

(i) "is permanently deflected downwards to such an extent that it is at all times incapable of dazzling any person standing on the same horizontal plane as the vehicle at a greater distance than 25 ft. from the lamp, and whose eye-level is not less than 3 ft. 6 in. above that plane; or

(ii) "can be deflected downwards or both downwards and to the left at the will of the driver in such manner as to render it incapable of dazzling any such person in the circumstances aforesaid; or

(iii) "can be extinguished by the operation of a device which either deflects the beam of light from another lamp in accordance with sub-paragraph (ii) of this paragraph or brings into, or leaves in, operation a lamp or lamps (other than the obligatory front lamps) which comply with sub-paragraph (i) of this paragraph."

Another important clause is that every electric bulb showing a light to the front must have the wattage marked on it. Also, an electric bulb of a power exceeding 7 watts shall be kept

illuminated while the vehicle is stationary on a road except during an enforced stoppage.

The legal mounting height of auxiliary "pass" lights or fog lights is a minimum of 24 in. from the ground, measured to the centre of the light. Lower mounted lights may be used only in fog or when snow is falling.

Mascots. If you want to fit a mascot to your car do not fix it in a position likely to cause injury to any person in the case of a collision.

Motor-horn Silence. A motor horn should not be used at any time when a vehicle is stationary on the highway, but an exception is made when it is necessary to do so for reasons of safety.

Moreover, there are in existence what are known as "Silence Zones." A horn may not be sounded between the hours of 11.30 p.m. and 7 a.m. in any built up area.

If a dangerous situation should occur, however, with the possibility of injury to a pedestrian or a large insurance claim for damage, it would be preferable to sound the horn and take the risk of being fined a few shillings.

Motoring Elsewhere than on Roads. It is unlawful for any person to drive a motor vehicle on to or upon any common land, moorland, or other land of whatsoever description (not being land forming part of a road) or on any road being a bridleway or footway, unless so authorized. This provision does not prevent the parking of vehicles on land within fifteen yards of the road, or driving on land in cases of extreme emergency, such as the saving of life or extinguishing a fire.

Motorists' Organizations. Many excellent services are available for motorists joining the organizations formed for their benefit. The advantages to be secured for a small annual subscription are road service, full guidance for tours, legal defence, and also technical advice. Full details of membership can be obtained from the secretaries of the following well-known organizations: Royal Automobile Club, Pall Mall, London, S.W.1, and the Automobile Association, Fanum House, Coventry Street, London, S.W.1.

Obstruction. Be careful when you leave your car if you wish to avoid summonses for obstruction. Thousands of motorists are convicted annually for offences of this kind. Although in quiet side streets it is often safe to leave a car unattended outside a house, it is definitely not safe to do so in a street where there is any considerable volume of traffic, and to leave a car unattended in a busy thoroughfare is to invite trouble. In certain places streets are to be found where parking is allowed, and this is indicated by a "P" sign.

Pedestrian Crossings. In an endeavour to reduce the number of road accidents, pedestrian crossings have been instituted. These crossing-places for foot passengers are indicated by means of black and white stripes, with yellow beacons at each end as prescribed for the purpose by regulations of the Minister of Transport.

Drivers approaching a crossing are to proceed at a speed that will enable them, if required, to stop before reaching the crossing. Where the crossing is not controlled by a police officer or light signals, pedestrians have precedence over all vehicular traffic at these crossings. Drivers are not to stop on any crossing unless it is necessary to do so to avoid accident.

Reckless, Dangerous, or Careless Driving. These forms of driving are regarded as very serious offences and may result in imprisonment and disqualification from holding a licence. Motorists must not drive on a road recklessly, or at a speed or in a manner which is dangerous to the public. Careless driving is defined as driving without due care and attention or without reasonable consideration for other persons using the road. A police officer has power to arrest for these offences without warrant, unless the driving licence is produced or the driver's name and address is given to him. Anyone driving furiously to the danger of the public may be arrested by any person without a warrant.

Speed Limit. This is now in force and is fixed at 30 m.p.h. in built-up areas. A "built-up area" is defined as a length of road in which a system of street lighting is maintained by lamps not more than two hundred yards apart. Suitable signs have been erected in areas in which the speed limit is to be enforced. It must be remembered, however, that in certain areas, such as the Royal and municipal parks, there are definite limits to the speed of road vehicles.

Traffic Lights. The red, green and amber lights are now familiar to all road users. The red and green disks give definite "Stop" and "Go" instructions, and the chief difficulty has been the amber light. Simultaneous lighting of red and amber disks means "prepare to start," and the crossing should not be taken until the green light is displayed. Amber following the green light is equivalent to "Stop," unless the vehicle is in such a position as to render crossing essential—to prevent an accident through sudden stoppage, or to avoid obstruction. Do not "race the lights."

Windscreen Wiper. All motor-cars must be fitted with a windscreen wiper and it must be maintained in good working order.

CHAPTER III

MAINTENANCE AND FAULT TRACING

IN dealing with matters pertaining to maintenance it is preferable to start at the moment that the new vehicle is delivered to its owner, for the most important period of its life is its first thousand miles. If it is neglected in its early days it may develop faults that cannot afterwards be eradicated without a substantial overhaul. On the other hand a little extra care during the first few weeks of ownership is amply repaid by increased longevity and improved performance.

In reading this and the following chapters, one might come to the conclusion that the 10 h.p. Fords demand rather a lot of attention. This, however, is not the case, for this small car will get along with less in the way of maintenance than any other vehicle in its class and, furthermore, it will stand an almost unbelievable amount of abuse. It is, nevertheless, an acknowledged fact among engineers that a little extra care and attention to any machine as highly stressed as an automobile pays a generous dividend. Some may regard two oil changes in the first thousand miles an extravagance, but the improvement in oil and petrol consumption brought about by this item of maintenance will, over a period of 20,000 miles, prove to be a great economy.

It is not perhaps as widely known as it should be that the purchaser of a 10 h.p. Ford from an authorized Ford dealer often obtains a free inspection from that dealer after its initial 300 miles and again when it has completed its first thousand miles. The only charge the dealer usually makes is for three-quarters of a gallon of oil required to refill the sump after it has been emptied.

The operations under this free service are as follows—

(1) Change engine oil.
(2) Tighten cylinder-head nuts (300 miles).
(3) Oil and grease all round.
(4) Check oil in gearbox and rear axle.
(5) Check battery, specific gravity, and connexions.
(6) Check generator charging rate.
(7) Check distributor breaker points and gap.
(8) Clean sparking plugs and adjust gaps.
(9) Check all lights and horn.
(10) Check idling speed and carburettor adjustment.
(11) Check brakes.
(12) Check shock absorbers.

(13) Check tyre inflation pressure.
(14) Check front wheel alignment.
(15) Adjust steering gear thrust bearing (1000 miles).
(16) Check clutch pedal adjustments.

As this is all valuable service the new owner will be foolish if he does not avail himself of it.

For the benefit of those owners who wish to undertake these operations for themselves complete details are given later in this book under their appropriate headings. In addition to the greasing and oiling service given by the dealer, the owner should go over the car with an oilcan, lubricating those minor joints such as door and bonnet hinges, bonnet catches, controls and door locks that usually do not receive attention from one year's end to the other. Details of these maintenance operations are given later in this chapter under the heading "Lubricating the Minor Parts." AS EVERY ITEM SPECIFIED UNDER THIS HEADING SHOULD RECEIVE ATTENTION BEFORE THE CAR HAS COMPLETED ITS FIRST 300 MILES IT SHOULD BE READ DURING THE FIRST FEW DAYS THAT THE CAR IS IN ITS USER'S POSSESSION.

Checking the Tightness of the Bearings. As soon as the owner has purchased the car and has had the opportunity of taking it for a run he is recommended to check the state of the bearings with the starting handle while the engine is WARM. The springy compression resistance of each of the four cylinders will be felt individually at each half turn of the starting handle and, in addition, there will be the drag of the tight bearings and pistons. While the car is still brand new the drag of the tight bearings may be so considerable that difficulty will be experienced in cranking the engine over, but the compression resistance may not be very marked.

If this simple test is conducted at intervals of 100 miles the progress of the running-in process can be ascertained. Gradually, the bearing drag will give place to occasional tight spots and, in time, these too will disappear. With each successive test the compression will be found to have improved.

Safe Speeds During Running-in. The Ford Motor Company recommend the following maximum speeds for the first 500 miles: Top gear, 30 miles per hour; second gear, 17 miles per hour; bottom gear, 10 miles per hour. These recommendations should, however, be applied with a little common sense, for there are occasions when 30 miles per hour can be more harmful than "fifty."

Aim at keeping the engine turning at a smooth even pace, avoiding both over-driving and labouring. If the speeds recommended are strictly adhered to there is no chance of damage through "over-revving" because they are less than half the maximum speeds of the engine, but if the driver persists in hanging

on to top gear when he should change down he causes the engine to labour, which is as harmful to it as racing.

The 10 h.p. Ford has a wonderful top gear performance, but do not take advantage of it during the running-in period. On all hills, and whenever extra slow running is desirable, such as in traffic, change down long before it is necessary to intermediate gear and keep the bearings turning smoothly. The car likewise has a very impressive rate of acceleration, but full advantage should not be taken of it during its early life. A safe maxim for the first 300 miles is "Never press the accelerator more than half-way down."

When the 300-mile inspection is concluded it may be found safe to indulge in occasional bursts of 40 miles per hour, but they should always be of short duration, not more than half a mile in length and under favourable circumstances, such as a slight down grade.

When is the Running-in Process Complete? After the initial 500 miles have been completed the car can be handled with more abandon but, contrary to the popular belief, the bearings are not completely run-in. It is true that it is quite safe to drive "all out" for a very short distance after that first 500 miles, but the car will not attain anything like its maximum performance until after the 1000-mile inspection.

At the end of 500 miles the engine is sufficiently free to enable the car to be driven faster than the family man habitually travels. These remarks are made merely to warn those who indulge in reliability trials and other sporting contests that, although the car is sufficiently free for normal use, a further 500 miles is necessary before one should try clocking a mile in 55 seconds or climbing Park Rash. Until the car has completed 700 miles keep the speed down to 50 miles per hour in top gear; 30 miles per hour in second gear, and 20 miles per hour in bottom gear.

Engine Lubrication During Running-in. It is impossible to over-estimate the importance of changing the engine oil after the first 300 miles and 1000 miles of the engine's life. The manufacturer chemically cleans the parts of the engine before assembly and, moreover, the bearings are flushed with oil before the sump is bolted on and the manufacturer changes the oil after the initial running-in. Despite these precautions the oil becomes very foul during the engine's first 300 miles, because microscopic particles of metal are worn off during the running-in period. These fall into the oil and form an abrasive. After 300 miles it becomes so fully charged that it is best drained out of the engine.

After changing the first lot of oil one should flush out the engine with flushing oil. The car is first taken out for a run until the engine is thoroughly hot and the oil is very fluid. The drain plug

is then removed and the dirty oil is allowed to run away. The drain plug is then replaced and half a gallon of a light flushing oil is put into the crankcase. The engine is now allowed to run briskly for ten to fifteen minutes in neutral. Briskly means the same speed as it would rotate in driving the car at a speed of 25 miles per hour. During this time this very light oil is flushing all the dirt out of the engine.

When the drain plug is removed this time it should be left out of the engine for a few minutes so that all the oil can drip away. While it is draining crank the engine over with the electric starter for five or six seconds to clear out the oil accumulated in the oilways. Fill up with three-quarters of a gallon of the correct grade of engine lubricant.

If the engine is flushed at 300 miles and the oil is changed again at the end of the first 1000 miles and then at each subsequent 1000 to 1200 miles, it will not be necessary to flush again through the life of the car. There is one word of warning, and that is: on no account should the engine be flushed with paraffin, which will ruin the bearings in a few seconds if the engine is run while it is in the crankcase.

With regard to colloidal graphite running-in compound, we recommend mixing the correct quantity for a new engine with the oil that is already in the power unit when it leaves the factory, and also with that which is put into it at the end of the first 300 and 1000 miles. Many owners add half this quantity of running-in compound to all subsequent oil changes or continue to maintain the graphited film with one of the many treated oils on the market. It is, however, the initial 2000 miles of the engine's life that are the most important.

The best way to put the compound into the engine is to pour a quart of lubricating oil into the crankcase, then the running-in compound, and finally the remainder of the oil. This ensures thorough mixing.

For upper cylinder lubrication mix half a pint of engine oil in the first five gallons of petrol, the oil being put into a separate two-gallon petrol can and shaken up with a gallon of petrol to ensure thorough mixing. This mixture is then poured into the tank and the remaining petrol added to mix the oil well into the fuel. After that, until the car has completed 1500 to 2000 miles, either a quarter of a pint of engine oil to five gallons of petrol or the recommended amount of upper cylinder lubricant is used.

Engine oil and upper cylinder lubricant are usually regarded as being equally effective, but the special lubricant is more convenient to use, as it mixes easily with petrol.

Tightening the Cylinder-head Nuts. The cylinder-head nuts should always be tightened down when the engine is HOT. It

will be found that after the engine has run only from twenty-five to fifty miles that the nuts holding the cylinder head in place have become a trifle loose. This is because the gasket has commenced to bed down. Tighten each one in turn with the tube spanner provided in the kit. After that they should be tightened again at 300 miles and they will need no further attention until the cylinder head has been removed for decarbonization.

BEFORE COMPLETING THE FIRST 300 MILES READ THE NEXT SECTION.

LUBRICATING THE MINOR PARTS

This maintenance operation takes but an hour and it is additional to the usual lubrication and maintenance operations. It deals with the almost invariably neglected minor parts of the chassis and body. If it is conscientiously undertaken when the car has completed its initial 300 miles and again at intervals of 5000 miles the car will remain free from squeaks and rattles. BEFORE COMMENCING WORK CLEAN THE CAR THOROUGHLY.

The Bonnet. Drip oil on both edges of the chromium-plated strip that runs along the middle of the top of the bonnet, as they constitute the top bonnet hinges. Work both halves of the bonnet up and down a few times to spread the lubricant. While the bonnet is up lubricate the catches that secure it. It will be noticed that both ends of the bonnet rest on strips of webbing. Grease these, rubbing the grease in thoroughly with the fingers. You will be surprised how much more silently the car will run.

Doors and Door Locks. Open the doors and oil the hinges with cycle oil; put a couple of drops of this on the place where the door-lock handles and window-winder handles enter the doors. Smear a very light film of grease on the latch and its striker plate. Examine the paint round the edge of the door and see if it discloses the fact that at one place the door has been rubbing against its post. A thin film of grease here will stop a squeak and protect the paint, but do not be too lavish as the surplus may be wiped off on to your passengers' clothing.

Floorboard Squeaks. Open the front doors and lift out the front compartment carpet. Spread a light film of grease over the pedal shanks where they rub against the carpet and their rubber guards but use only a minimum amount, as a superfluous amount will stain the carpet. Put a few drops of cycle oil on the trigger of the hand brake. It will be noticed that there is a thin fabric strip round the edge of each floorboard. Drip cycle oil on to this. It will soak into the fabric and cure a few more squeaks.

Battery Connexions. Disconnect the earth lead from the battery. (This is the lead-covered, flat, bare lead that connects the battery to the dash, see Fig. 8.) You will now be able to operate the

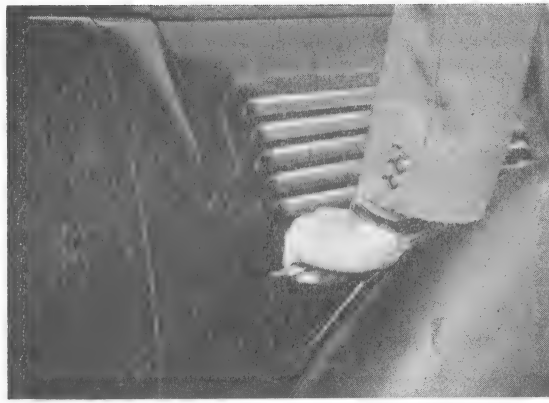


FIG. 7. THE BONNET IS RAISED BY PRESSING DOWN THE SECURING HANDLE (DE LUXE MODELS)

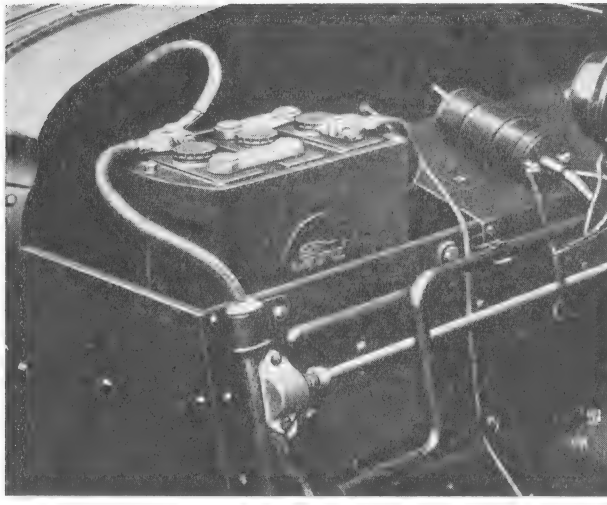


FIG. 8. SHOWING THE ACCESSIBLE POSITION OF THE BATTERY (DE LUXE MODELS)

starter control without setting the starter in motion. Now pull out the starter control and put a few drops of cycle oil on it. Lubricate the exposed part of the inner wire at the starter end. Drip oil on to the outer casing and work the control a few times. The oil will percolate through to the inner wire. Treat the starting device control in a similar manner. On later models a silver coloured plaited flexible flat metal lead connects the near-side front engine support to the frame. See that the bolts at the ends of this are tight to ensure a good return circuit for the ignition current.

Windscreen Wipers. Couple up the battery, start the engine, and set the windscreen wipers in motion. Put three or four drops of cycle oil on the windscreen-wiper spindles. Put a drop or two of oil on the ball joint at each end of the rod connecting the two wipers.

Engine Controls. With engine oil lubricate the two bearings of the accelerator shaft. Put a few drops of cycle oil on the ends of the throttle spindle, preferably when the engine is running slowly so that the suction carries it along the bearings. The ball joints on the end of the rod connecting the throttle with the lever on the end of the accelerator shaft can be forced off their balls by pulling the joint away from the rod in the direction of the arrows, see Fig. 9. Ram grease into the joints with the fingers and replace them.

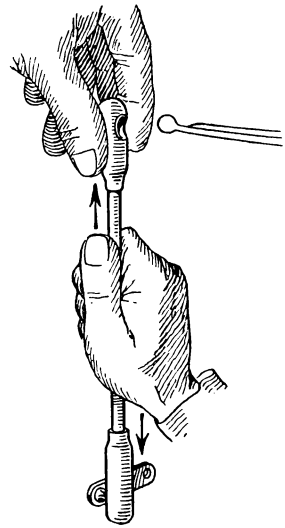


FIG. 9

To dismantle the throttle control ball joints, pull the spring loaded body of the joint away from its rod in the direction of arrows. The joint can then be lifted off the ball and filled with grease

Stop Light Switch. Jack up the car or run it over a pit so that you can get underneath it. The stop light switch will be seen alongside the rod connecting the brake pedal with the cross shaft on the centre cross member. Coat the projecting ends of the small steel rod running through the switch with grease.

Brake and Clutch Controls. The handbrake lever slides within a square section tube. A few drops of oil on the end of this will find their way on to the working surfaces and the brake ratchet. Grease gun nipples will be found on the brake shaft and on the brake compensators on the front and rear axles. These should

receive attention with the grease gun every 1000 miles. Smear a little grease on the exposed end of the handbrake cable which may be seen underneath the chassis attached to a lever on the brake shaft, just behind the gearbox. Drip a little oil on the exposed end of the inner sliding part of the telescopic member connecting the brake pedal with the brake cross-shaft. Oil should be dripped on each of the clutch and brake control clevis pins.

On the short wheelbase De Luxe models made before 1937 you will see a sliding link on the end of the rod connecting the handbrake to the cross shaft and there is a second sliding link just below it. Clean these and place a few drops of oil on the wearing surfaces to protect them. Grease the ratchet teeth of the handbrake and oil the joint made between the rod that operates it. Put a few drops of oil on each of the brake and clutch control clevis pins.

The springs of the De Luxe model should be sprayed with penetrating oil but there is a grease gun nipple in the end of the spring bolt in the centre of the spring of the 1937 and later Tens.

While you are under the car check the tightness of the nuts holding the sump to the cylinder block and flywheel housing. Check also the level of the oil in the gearbox by unscrewing the square-headed plug that you will find half-way up the side of the box. If oil flows out, the box contains sufficient lubricant. The rear axle should be similarly checked by removing the plug that is located to the rear of the centre portion of the axle casing. The squared end of the handle of the adjustable spanner provided in the tool kit fits in the square recess in the plug and should be used to remove the plug.

If this attention has been conscientiously given to the car after it has covered its initial 300 miles, a number of incipient squeaks and rattles will have been cured. The fact that the brake and other controls have been thoroughly lubricated makes the brakes more efficient and the car more responsive to the controls. This service need not be given to the car again for at least 5000 miles.

Routine Lubrication

The lubrication and maintenance operations of the De Luxe and Ford Ten can be divided into four groups. Group 1 requires attention daily or at intervals of not more than 200 miles on a long continuous run; Group 2 are points requiring attention at 1000-mile intervals; Group 3 at 3000-mile intervals; and Group 4 items call for attention every 5000 miles.

Group 1

The only items calling for attention under this heading are the petrol, engine oil, and water levels. Check all three before starting

each day's run. As already stated, it is necessary to turn the ignition switch "on" before the petrol gauge will register.

Very little need be said about these operations except to indicate the desirability of removing the spare oil can, and its carrier, as it interferes with the accessibility of the dip-stick. To read the

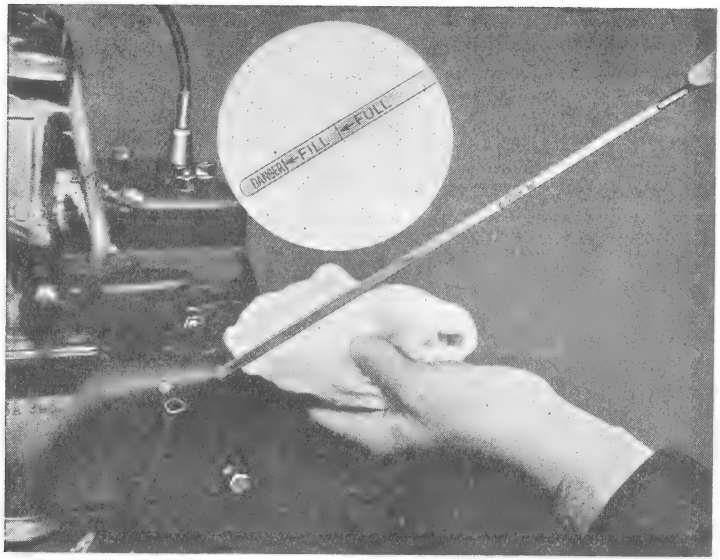


FIG. 10. USING THE DIPSTICK

dip-stick (Fig. 10) pull it out of its hole, wipe it dry, re-insert it, and pull it out again. The mark made by the oil will indicate the level. It is, however, essential to see that both prongs of the dip-stick engage the hole and that the stick is pushed right home, or you will not get a true reading.

The oil filler on this model does not allow of very quick filling, but this operation is facilitated by partially withdrawing the dip-stick so that the air can escape at this point and so allow the oil to enter more easily.

Although the oil will continue to circulate as long as the level is above the letter "L," or "danger" mark, near the bottom of the stick, it is advantageous to keep the oil level up if you indulge in continuous high speed driving. (The sump is full when the oil

level reaches the letter "F" or "full" mark on the stick.) The reason is that the larger volume of oil tends to keep cooler.

Petrol, Oil, and Water Capacities. The petrol tank holds 6½ or 7 gallons and the cooling system 1½ gallons. The following are the oil capacities of the various units: engine 4½ pints, gearbox 1½ pints, rear axle 1 pint.

Special Lubrication Charts. Wall charts have been specially prepared for your car, and the Patent Castrol Wall Chart issued by Wakefields can be obtained by sending a post card to C. C. Wakefield & Co. Ltd., Grosvenor Street, London, W.1.

In these charts the lubrication points are clearly indicated, together with the approved grade of lubricant or grease which should be used. In addition there are details as to the mileage period at which attention should be given and instructions on the lubrication of the gearbox, back axle, etc.

Winter and Summer Oils. If summer oil is used in winter difficult starting may result. There is also a possibility of damage in frosty weather, when the engine is being started for the first time in the morning, because the thick oil will not flow sufficiently freely to lubricate properly until it has warmed up a little. Winter oil, on the other hand, flows freely at freezing temperatures, but it thins out too much if it is used in the summer and the car is driven hard for a prolonged period. The gear lubricants have been specially produced for use with synchro-mesh gears.

Group 2

The various grease-gun nipples on the chassis should be given attention every 1000 miles and at the same time the engine oil should be changed. As these are both rather messy operations you will be well advised to run the car into the nearest Ford dealer's premises for the complete service that is necessary after 1000 miles running. For the benefit of those who wish to do this work themselves it is detailed in this chapter (see Fig. 11).

Change the Engine Oil. After every 1000 miles drain the engine oil. The work is best performed after the car has come in from a long run, because the oil is then warm and more fluid. Remove the drain plug and keep it out for some minutes to allow all the oil to drip away. Replace the drain plug and fill. The correct amount is 4½ pints but no harm will result if you tip in three-quarters of a gallon.

Lubricating the Clutch Release Bearing. The Ford Ten is fitted with a clutch release bearing that is filled with grease during the course of manufacture and needs no lubrication or other attention throughout the life of the car.

Some De Luxe model bearings are lubricated by a grease cup

located under the metal dome on the floorboards just in front of the gear lever. To remove this dome, slacken off the three screws that hold it in place. Twist the dome and it can then be lifted over the heads of the screws. Every 1000 miles remove the grease cup, fill it with grease and screw it down, as far as it will go. The cup forms a measure as well as a means of injecting the lubricant into the bearings.

Use of the Grease Gun. Every 1000 miles grease should be forced into all the nipples marked *A* on the Lubrication Chart (Fig. 11). To do this pull out the handle of the grease gun, press the nozzle of the gun squarely on the end of the nipple, and, with the other hand, press in the handle. This will force the grease through the nipple into the bearing. Continue working the handle until you see the clean grease forcing the dirty grease out of the ends of the bearing. Wipe the end of the nipple clean before applying the grease gun.

As the perfection or otherwise with which the grease gun does its work is bound up with the method of filling and the kind of grease employed, a few words on this subject are desirable. Unless the grease is packed properly in the gun air pockets form which interfere with its operation. It is best to buy the grease in the type of easy-filling tin that has been produced by the grease manufacturers for loading grease guns. Unscrew the bottom cap of the gun, push the handle down AS FAR AS IT WILL GO, and then press the gun onto the top of the easy-filling tin until it is completely full. Then screw on the cap.

Should the gun jam pull the handle out and tap the end of the nozzle on a piece of SOFT wood. This will cause the grease to pack itself into the nozzle.

When greasing it is desirable to clean the dirt out of the sliding links on the brake cross shafts behind the centre cross member and oil the working surfaces lightly with engine oil.

Oiling the Generator. The rear bearing is oiled through a small cup with a spring lid and the front bearing through a hole covered with a spring blade which can be pushed aside with the nozzle of the oil gun. Give each bearing three drops of engine oil every 1000 miles. More oil should not be given as the excess may find its way into the generator and cause trouble. (On the current Tens the front bearing is self lubricated and the rear from a vaseline filled well.)

Distributor. Fill the spring cup under the distributor with engine oil every 1000 miles and spread a VERY LIGHT film of vaseline on the face of the cam.

On some of the distributors fitted to this model there is a round felt pad held in contact with the cam. Where this pad is provided it should be kept damp by putting a few drops of engine

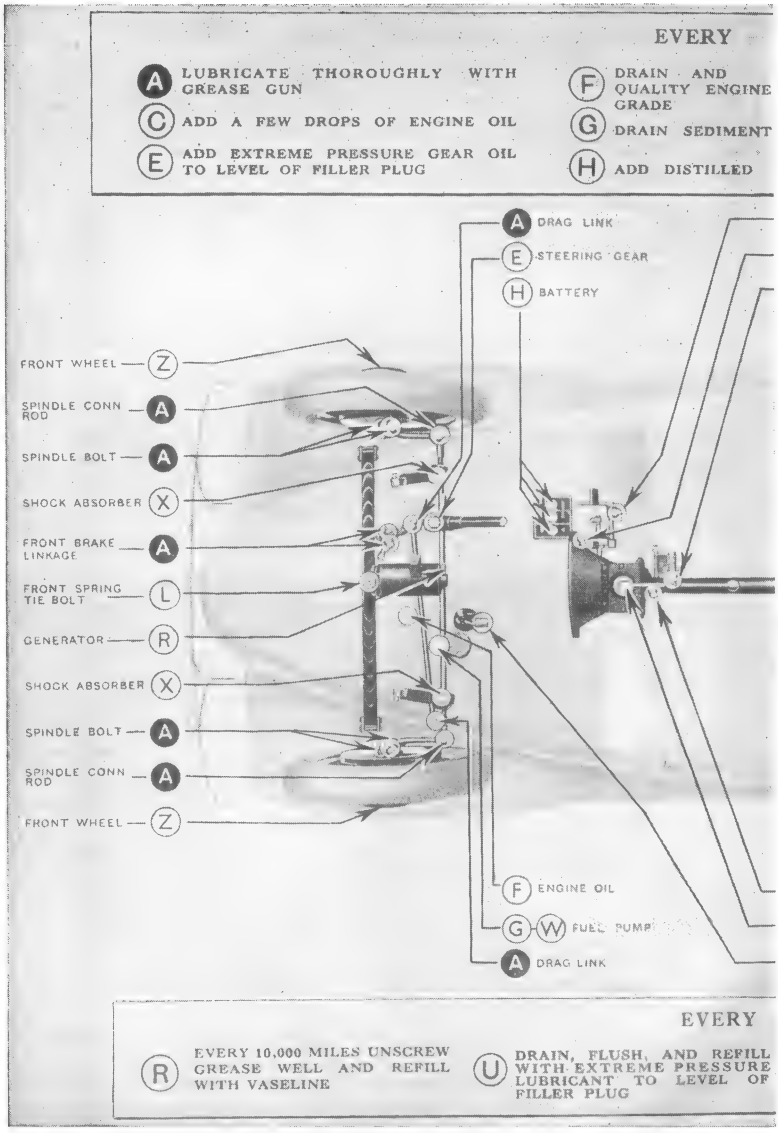

EVERY
A LUBRICATE THOROUGHLY WITH GREASE GUN
C ADD A FEW DROPS OF ENGINE OIL
E ADD EXTREME PRESSURE GEAR OIL TO LEVEL OF FILLER PLUG
F DRAIN AND QUALITY ENGINE GRADE
G DRAIN SEDIMENT
H ADD DISTILLED
A DRAG LINK
E STEERING GEAR
H BATTERY
FRONT WHEEL Z
SPINDLE CONN ROD A
SPINDLE BOLT A
SHOCK ABSORBER X
FRONT BRAKE LINKAGE A
FRONT SPRING TIE BOLT L
GENERATOR R
SHOCK ABSORBER X
SPINDLE BOLT A
SPINDLE CONN ROD A
FRONT WHEEL Z
F ENGINE OIL
G W FUEL PUMP
A DRAG LINK
EVERY
R EVERY 10,000 MILES UNSCREW GREASE WELL AND REFILL WITH VASELINE
U DRAIN, FLUSH, AND REFILL WITH EXTREME PRESSURE LUBRICANT TO LEVEL OF FILLER PLUG

FIG. 11. PREFECT

Earlier models are similar. Recent cars have a drive shaft This requires greasing

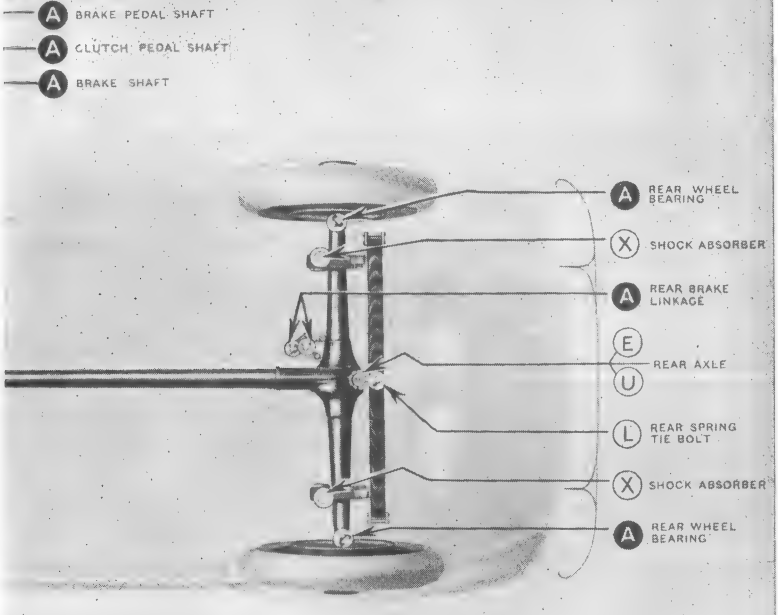
1,000 MILES

REFILL WITH GOOD OIL OF CORRECT

WATER

(J) LUBRICATE THOROUGHLY WITH UNIVERSAL JOINT GREASE

(L) LUBRICATE SPRINGS THROUGH NIPPLE INCORPORATED WITH CENTRE BOLT. USE SPECIAL LUBRICANT



5,000 MILES

(W) REMOVE AND CLEAN SCREEN

(X) ADD FORD SHOCK ABSORBER FLUID TO LEVEL OF FILLER PLUG

(Z) PACK WITH GOOD QUALITY WHEEL BEARING GREASE

LUBRICATION CHART

centre bearing lubricator midway along the propeller shaft every 1,000 miles

oil on it every 1000 miles. This lubricates the cam and obviates the necessity for using vaseline.

Spray the Springs. On the De Luxe model it is necessary to spray the springs with penetrating oil every 1000 miles. The Ford Ten has a grease gun nipple fitted to the tie bolt on the centre of each of the springs. Special Ford grease should be injected into this every 1000 miles, until it is seen working its way out between the leaves. While ordinary chassis lubricant can be used, the greases recommended are those having a high melting point.

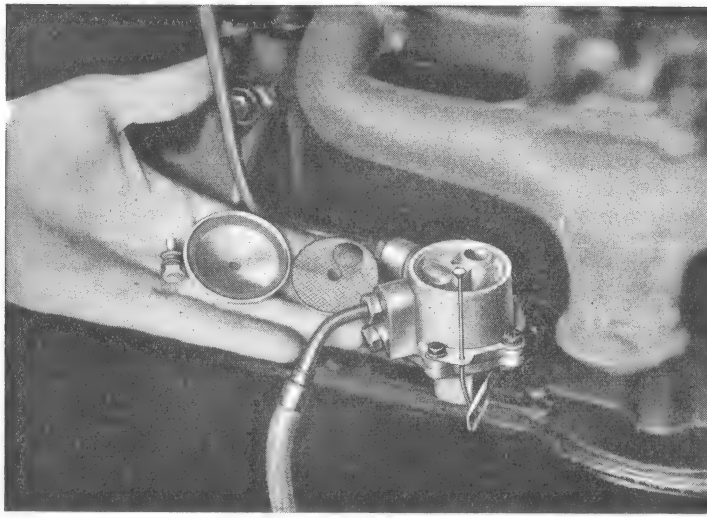


FIG. 12. THE PETROL PUMP FILTER REMOVED FOR CLEANING

Clean the Fuel Pump. Loosen the petrol inlet union which is situated immediately above the drain plug and run off the sediment by removing the drain plug. Always make sure that the union and drain plug are tight before attempting to start the engine.

Battery. Every 1000 miles or every two weeks (whichever occurs first) add sufficient clean DISTILLED water to bring the electrolyte to the correct level. (See page 52 for complete instructions.)

Electrical System. Check the tightness of the sparking-plug terminals. Clean the insulated base of the coil, the insulated

parts of the distributor, the sparking-plug insulators, and the top of the battery with a dry rag.

Tyres. Every 1000 miles or once a week check the pressure of the tyres, not forgetting the spare wheel. Correct pressures are: 28 lb. per square in. for 4·50 in. × 17 in. tyres; 24 lb. per square in. for 5·00 in. × 16 in. tyres.

Group 3

Three thousand miles after the car has had one of its 5000-mile overhauls carry out all the operations scheduled under Group 2, and in addition the following items which are each detailed under their respective headings—

Check the adjustment of the front hubs.

Check the oil level in the gearbox.

Check the oil level in the rear axle.

Lubricate the steering gear and check the adjustment.

Group 4

Every 5000 miles carry out all the operations scheduled in Group 2. (See page 26.) In addition to this lubricate the minor parts, following all the operations scheduled earlier in this chapter (Lubricating the Minor Parts).

The oil should be drained from the sump and the external oil filter unit fitted to recent cars should be changed every 7000 miles. If the oil becomes dirty for any reason before this mileage is reached, the engine must be refilled with clean, new oil and the filter unit replaced.

When refilling the sump, add approximately one pint of oil in addition to the normal quantity of 4 pints to allow for that which will be retained in the new filter unit.

To change the filter unit, unscrew the two oil pipe unions connected to it, taking care to hold the adaptors with a second spanner to avoid twisting the pipes. Transfer the two adaptors to the new filter unit, taking care that the washers are in good condition. Loosen the clamp bolt and withdraw the filter unit. Fit the new filter unit in the mounting bracket, tighten the clamp bolt and re-connect the oil pipes. Test for leakage when the engine is restarted.

Lubricate and adjust the front hubs in the manner described in Chapter IX, page 72, and check the tightness of the spring attachments. This operation is described in Chapter IX, page 75.

The gearbox and rear axles should also be drained and refilled. Flush the cooling system and clean the fuel pump filter. The method of doing this is described on pages 49 and 30 under the appropriate headings. Clean the air filter (if fitted). See page 71.

APPROVED LUBRICANTS

	ENGINE		GEARBOX AND REAR AXLE
	Winter	Summer	Winter and Summer
Vacuum	Mobiloil Arctic	Mobiloil A	Mobiloil GX 90
Vigzol	Vigzol D. 20	Vigzol D. 30	Vigzol Hy-EX 90
Wakefield	Castrolite	Castrol X.L.	Castrol S.T.
Esso	Essolube 20	Essolube 30	Expee Compound 90
Duckham's	N.O.L. "Twenty"	N.O.L. "Thirty"	XS-Press 90
Shell	X–100 20/20W	X–100 30	Spirax 90 EP
Price's	Energol S.A.E. 20	Energol S.A.E. 30	Energol EP S.A.E. 90
Speedwell	Hyduty 20	Hyduty 30	Hyduty EP 90

LUBRICATION UNDER EXTREME CONDITIONS

NORMAL TEMPERATURES	ENGINE OIL
Above 90° F.	S.A.E. 40
35° F. to −10° F.	S.A.E. 10 W
Below −10° F.	S.A.E. 10 W plus 10 per cent paraffin

ENGINE FAULT TRACING

The tracing and rectifying of troubles is normally best left to a Ford dealer, who possesses specialized test equipment; this eliminates the possibility of error and speeds up the process immeasurably. Instances are bound to occur from time to time, however, when the driver must tackle the problem himself, even though it may be possible to apply only first-aid measures which will enable the car to be driven home, or to the nearest garage, for more elaborate repairs.

The more ambitious owner will find the fault-tracing charts on pages 98–9 useful, and may also be interested in a practical book.

published by Sir Isaac Pitman & Sons, Ltd., entitled *Automobile Fault Tracing.*

If the engine cannot be started, the trouble will generally be due to carburation or ignition faults, although mechanical faults cannot be entirely ruled out. To isolate the cause of the trouble, first check that the ignition has been properly switched on and that there is an adequate supply of petrol in the fuel tank. Then make sure that petrol is being supplied to the carburettor, and that other faults described on pages 69–70 do not exist.

If the fuel supply is in order, the ignition system should be checked to ensure that a spark occurs at each sparking plug once for every two revolutions of the engine, whether cranked by hand or the starting motor. To test, crank the engine and hold a wooden-handled screwdriver with the tip touching the cylinder head, and with the steel shaft approximately $\frac{1}{64}$ in. away from the sparking plug nut. If no spark jumps the gap the ignition system is at fault, and further ignition tests described in Chapter VII must be applied.

Incidentally, neon-type plug testers are not altogether reliable; they will show a flash even if the sparking plug points are short-circuited, so that some experience is required to interpret their indications correctly.

If the engine starts but overheats after a short period of operation, check the oil level in the engine and the water level in the radiator and replenish each as required. However, if the water is extremely low, allow the engine to cool off before adding water. The sudden contraction of the cylinders produced by the cold water will possibly crack them.

Should the performance of the engine at any time become sluggish or noisy, consult any authorized Ford dealer. Regular inspection of your car by a Ford dealer will render the possibility of trouble on the road remote.

Knocking. A light knocking or tinkling sound (known as "pinking") may be due to the combustion chambers having become carboned up, in which case the engine will require decarbonizing. Pre-ignition may be a cause when unsuitable plugs are fitted, or when the ignition has become too far retarded, thus causing overheating. Knocking may also occur if the ignition has been set too far advanced or if the water has boiled away. A heavier metallic knock or clatter is generally a sign of a worn or "run" connecting rod bearing. Obtain expert advice before continuing to run the engine.

CHAPTER IV

DECARBONIZING AND VALVE GRINDING

THE Ford Motor Company Limited are one of the very few motor manufacturing concerns that do not specify definite periods for decarbonizing. In that they are very wise, for there is no period that is more difficult to define.

How Often Does the Engine Need Decarbonizing? One could state that the engine must be "decoked" every 6000 miles, but experience would prove that some engines need attention at slightly more frequent intervals, say 5000 miles, while others will run as many as 8000 or even 9000 miles between overhauls.

If you are a bad driver, use poor fuel and oil and generally neglect the car, decarbonizing may be required as frequently as at 5000 mile intervals. If, on the other hand, you do everything in the best possible manner, the engine may not really need decarbonizing in 10,000 miles but the cylinder head should certainly come off before that distance has been completed and the valves receive attention.

Observe the general performance of the car. An engine that needs decarbonizing is generally a little below par in every respect. If the engine overheats and boils on hills and when pulling hard, and if it knocks or "pinks" continuously under these circumstances decarbonizing is necessary. This light metallic tinkling sound is easily recognized, but it is worth remembering that it can also be caused by too great a degree of ignition advance, as described on page 64.

If, on pulling up on the starting handle slowly, so that the compression in each individual cylinder can be felt, one or more cylinders appear to be weak it is not unlikely that the valves need attention, especially if the engine has done a considerable mileage since its last overhaul.

The formation of carbon is a natural phenomenon, but it is accelerated by the following malpractices—

(1) Running the engine after it is warm with the starting device in use causes a rich carbon-forming mixture to be fed to the engine.

(2) A loose jet in the carburettor gives an over-rich mixture.

(3) Poor quality oil.

(4) Running an engine in a badly neglected state so that the piston rings are passing oil and allowing the engine to smoke.

Loss of compression and general loss of tune are accelerated by—

(1) Continuous and brutally hard driving particularly when poor quality fuel and oil is used and the car is generally neglected. (Fast driving is not of necessity brutal driving and the really fast man is seldom brutal to his car.)

(2) Running the car with insufficient water in the radiator and insufficient or poor quality oil in the engine.

(3) Running with the starting control in use after the engine has warmed up produces a rich slow-burning mixture which tends to overheat the exhaust valves.

(4) Tampering with the ignition setting and getting the timing wrong.

Needless tinkering is to be strongly deprecated. When, however, decarbonizing becomes necessary, make it a practice to attend to the valves and give the power unit installation something in the nature of a fairly comprehensive check over, so that once this somewhat lengthy operation is completed the tools will not be required to be used again on an operation of this kind for many thousand miles.

The importance of cleanliness in automobile maintenance work cannot be over-emphasized. Before re-assembling the job clean all parts thoroughly and wash your hands to be sure that no dirt is assembled into the engine. It is also important to be accurate in all settings and adjustments. "0·020 inch" does not mean "a small amount." It means "just twenty thousandth parts of an inch." No more and no less.

Parts such as valves and valve guides, and any other pieces that have been subjected to wear and alternate heating and cooling bed into each other in service and must not be mixed. A valve, for instance, must always be assembled into the guide and on to the seat from which it was taken. For that reason at least eight boxes with numbers painted on them so that they can be readily identified, must be available. If all parts are numbered from the front end of the engine and placed in their correct boxes they will not be re-assembled into the engine in the wrong order. A pad and pencil with which to make notes is always a safer method of working than trusting to the memory.

Stripping the Engine. Run the engine until it is warm and drain off the oil. (This is not really necessary if you are merely decarbonizing but even then it is desirable.) Drain the water from the cooling system.

Undo the two screws that hold the rear end of the top bonnet hinge to the scuttle and lift off the bonnet. (It is advisable to get assistance with this job as the bonnet is too clumsy for one to handle properly.)

Although it is not essential the battery can be removed, charged up and topped up while the engine is undergoing overhaul. Remove the distributor unit by taking off the screw that holds the end of the body clamp arm to the cylinder head and pulling the distributor off. (If the body clamp bolt is not interfered with the timing will not be disturbed.) Pull the wire connecting the distributor to the coil out of its socket in the distributor cover and put the distributor in a safe place for adjustment and lubrication. Note the position of the plug wires. The 1, 2, 4, 3, firing order necessitates the Nos. 4 and 3 plug wires crossing each other. Recent models are fitted with anti-condensation caps in the sparking plugs and snap-on terminals.

Slacken off the generator clamp nut three turns, tap the end of the clamping pin to relieve the taper. Push the generator down to slacken the belt and lift the belt off the generator pulley. Uncouple the wire connecting the cut out on top of the generator with the ammeter and lift off the generator.

ALWAYS REPLACE ALL SMALL SCREWS TO PREVENT THEM BEING LOST. While the generator is off examine the brushes and clean the commutator as described on page 56.

Remove the two screws that hold the water outlet pipe to the cylinder head and tie the pipe up out of harm's way. On later engines the hose must be detached from the cylinder head and radiator pipes. Slack each cylinder head nut off one turn. Turn the engine over briskly with the starting handle for three or four revolutions and the compression will help to loosen the cylinder head joint. Remove the sparking plugs and, before re-fitting them, clean them and set their gaps to the correct amount. Now spin off the cylinder head nuts and you should be able to lift the head off. If it sticks tap it, using a wooden drift at the sides close to the joint, in a slightly upward direction.

When the cylinder head and gasket have been lifted off turn the engine over slowly with the starting handle so that each valve is, in turn, raised fully off its seat. Critically examine each valve face and seat for pits and signs of burning or valve warping. If you are certain that the valves are in perfect order there is no need to strip the engine any further, for sufficient has been removed to enable it to be decarbonized. (This process is described later in this chapter on page 40.)

Should the valves require attention—and, in my opinion, it is always advisable to take the opportunity of touching them up while the cylinder head is off—the manifolds must be removed. Uncouple the exhaust pipe and disconnect the petrol feed to the carburettor. Disconnect the carburettor controls and pull off the rubber windscreen wiper tube. When the four nuts that hold the manifolds on to the cylinder block are removed, with the tube

spanner provided in the tool kit, the manifold assembly complete with the carburettor can be lifted away from the engine in a single unit.

Take off the valve chamber cover. This job will be facilitated if the petrol pump is first removed. The top centre valve cover retaining bolt is shorter than the remainder on some engines; bear this in mind when reassembling.

The whole of the valve mechanism is now fully exposed. Ford

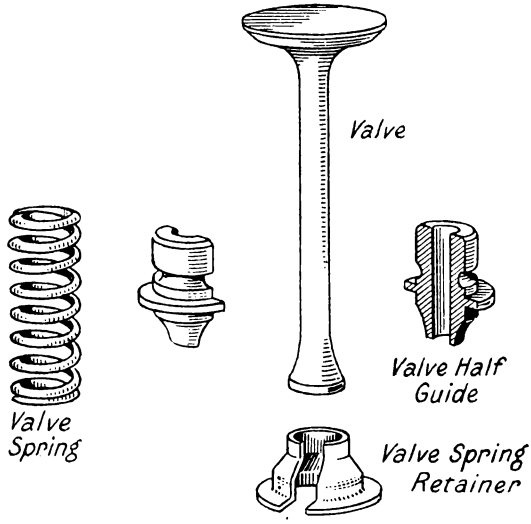


FIG. 13. FORD VALVE COMPONENTS

valves are of a special type with an enlarged foot which serves the dual purpose of providing a big contact area with the tappet top and a fixing for the valve spring cup. The valves are assembled in guides made in two halves and before they can be lifted out of the engine the valve guides must be removed.

Before attempting to remove the valves, plug the two oil return holes in the bottom of the valve chamber with clean rags to obviate the slight risk of one of the valve spring cups falling into the crankcase.

Removing the Valves. IT IS ABSOLUTELY ESSENTIAL THAT EACH VALVE IS GROUND INTO AND ASSEMBLED INTO THE SEAT FROM WHICH IT WAS REMOVED. IT MUST ALWAYS BE USED IN CONJUNCTION WITH THE VALVE GUIDE IN WHICH IT HAS WORKED.

THE IMPORTANCE OF THESE POINTS CANNOT BE OVER-EMPHASIZED. For that reason each valve, as soon as it is removed must, together with its spring, two half guides and spring cap, be put into a numbered box so that the parts are not mixed. Turn the engine over with the starting handle and watch the action of the valve. When it has just seated give the starting handle a further HALF TURN to assure that the tappet is well on the base circle of the cam.

To remove the valves it is necessary to compress the valve spring in an upward direction with a suitable tool, so that with the spring raised and the valve held on its seat, it is possible to remove the valve spring retainer or collet which normally rests on the mushroom-shaped foot of the valve stem. This collet is cut away on one side. Raise it clear of the valve foot and slip it off the valve stem.

The valve spring may now be released. With the valve pushed up as far as it will go, the spring can be withdrawn from its location round the split valve guide. The latter is then tapped downwards by means of a special tool which will prevent damage to the valve or valve guide. Any improvised tool should be used with great care. Pressure against the valve head, or allowing the tool to slip off the top of the valve guide against the valve stem, may bend the valve stem or cause bad burring. The two portions of the split valve guide must be kept together and must be replaced with the same valve in the correct position.

The valves, valve guides, valve ports, springs and valve spring retainers should be thoroughly cleaned and the valve faces and seatings examined.

Checking the Valve Clearance and Grinding-in the Valves. If a valve is badly burned a new one must be installed; if it is deeply pitted it should be refaced on a valve refacing machine by any authorized Ford dealer. It is always a bad policy to grind-in a badly pitted valve as a considerable amount of metal has to be worn off the valve seat in the process. Moreover it is very tiring work.

Ford valves have no screw-driver slot in the head as this slot tends to weaken valves. Because of this a suction type of valve grinder must be used. Very little valve grinding compound is required. A small quantity of the "fine" grade, applied to the valve face by a matchstick, is all that is necessary.

The whole art of grinding-in a valve consists of lightly spinning the valve first in one direction and then in the other, from time to time raising the valve off its seat and reseating it in a slightly different position, about a quarter or a half turn round, and grinding again from this new starting position. No pressure is required, the weight of the valve and the tool being sufficient to maintain the valve on its seat.

It may be found of help to purchase from your authorized Ford dealer a pair of valve guides. These can be used with each valve in turn, as it is ground in. If the existing valve guides are used, they must be kept in their correct location and with their own valves.

If a re-faced valve is used it will not be necessary to give any more grinding than will produce a complete and uninterrupted

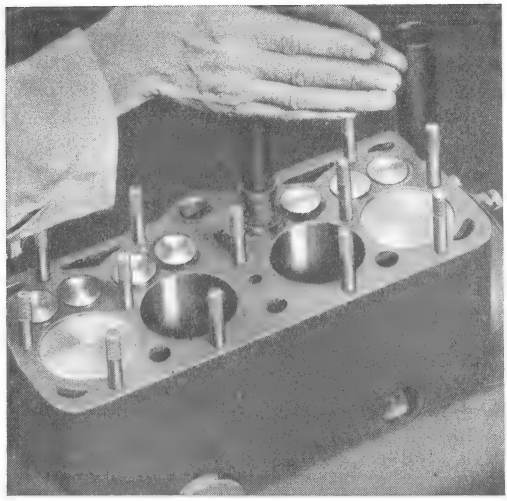


FIG. 14. USING THE SUCTION VALVE GRINDING TOOL

seat and this will require but little effort. (A properly ground valve and seat has a frosted appearance.)

After grinding, carefully wash every particle of grinding paste off the valve and its seat, scrape out the carbon from the valve port, wipe the oil sludge out of the inside of the valve chamber.

Turn the engine over until the valve is fully lifted. Rock the crankshaft a few degrees to make sure that the valve is really at the point of maximum lift. When this point has been found observe the position of the piston. It will be at or very nearly half-way up the cylinder. Measure the distance that it is down the cylinder bore and then give the crankshaft EXACTLY ONE COMPLETE REVOLUTION bringing the piston to exactly the same point. The tappet is now resting on the middle of the base circle of the cam, in the correct position for the valve clearance

to be measured. Check the clearance with a feeler gauge. It should be between 0·013 in. and 0·015 in. with the valve firmly on its seating.

If the clearance is less than 0·013 in., mark the number of the valve and the clearance on the head of the valve in quick drying enamel and take it to the Ford dealer. He will reface it and grind off the stem to the proper length to give the correct clearance. (Remind him to give an extra 0·002 to allow for the reduction in grinding-in.) The valve can be removed by pressing the two halves of the valve guides out of the cylinder block as just described.

IT IS USELESS TO ATTEMPT TO FILE THE VALVE STEM TO CORRECT THE CLEARANCE, for no man in the world is sufficiently skilled to produce a perfectly flat and true "ground finish" face. Measure the clearance and have the end of the valve ground off by an authorized Ford dealer on his refacing machine for then, and then only, can you be certain that the valve stem is ground off dead square. If the error is 0·001 in. or less the end of the valve stem may be dressed up on an oil-stone, making sure that the stem is held exactly at right angles with the stone during the process.

If the clearance exceeds 0·015 in., the valve must be ground-in further to reduce the gap.

Never assemble the valves into the engine with incorrect valve clearances for, if the clearances are too large, the engine will not develop full power and, moreover, it will be extremely noisy. If they are too small the valves will not close properly when the engine is hot and they and their seats will be damaged.

Before fitting the valves in their guides smear engine oil on the stems and make certain that all the grinding paste has been washed off the valve face and seat. Do not forget to remove the rags that you have stuffed in the holes in the crankcase. Before fitting the valve chamber cover clean the oil sludge off the inside and make sure that the machined faces on the cover and cylinder block are perfectly clean and that the gasket is undamaged. (It is always preferable to spend threepence on a new gasket.) Tighten the cover screws down half a turn at a time, starting with the three in the centre of the cover and working across diagonally from corner to corner of the cover. Make certain that all the screws are tight as the cover seals the main oil way and it is subjected to a high oil pressure along its bottom edge.

Decarbonizing. Bring two pistons to the top of their stroke and, while decarbonizing them, ram rag into the other two cylinders to prevent dirt and carbon particles falling into them. On no account may emery cloth or any other abrasive be used on the piston tops or cylinder block. Scrape the carbon off with

the end of a screw-driver, the back of a discarded hacksaw blade or an old pocket-knife, taking care not to damage the aluminium tops of the pistons or the machined surfaces of the cylinder block and cylinder head. Make sure that no carbon is trapped between the valve face and valve seat.

Decarbonize the cylinder head in the same manner. When

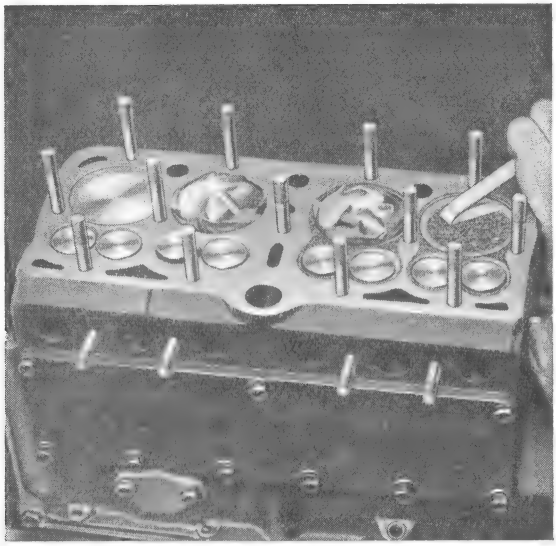


FIG. 15. DECARBONIZING THE PISTON CROWNS

all the carbon is removed wipe every trace of loose carbon out of the engine. The small specks can be blown out with the tyre pump. This often omitted part of the operation is important, for small carbon particles sometimes cause cylinder scores and valve pitting. Smear a little engine oil all round each of the cylinder walls and turn the engine over a few revolutions to spread the lubricant evenly.

Reassembling the Engine. Always fit a new cylinder head gasket whenever the cylinder head has been removed. There is no advantage in using any jointing compound; in fact, it is recommended that the gasket be fitted perfectly dry. Make sure that the cylinder and head faces and those of the gasket are absolutely clean, for any dirt trapped between them may cause a water or gas leak.

Lower the gasket on to the cylinder head and then, after removing the sparking plugs, lower the head on to the gasket. Spin the nuts on and then tighten them up half a turn at a time, working from the centre of the head outward, diagonally, to get an even pressure on the gasket. Tighten the nuts up in the order shown in Fig. 16 which should fulfil the conditions required to make a good joint. Make sure that every nut is as tight as it can be got with the tube spanner and tommy bar supplied in the tool kit.

Clean the sparking plugs, check their gaps and refit them.

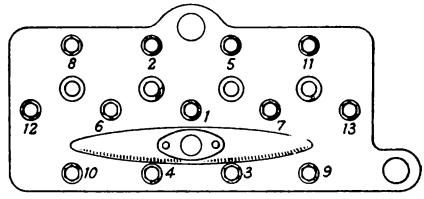


FIG. 16

Suggested order in which to tighten down the cylinder head nuts

making sure that the copper and asbestos washers are in position. Check the contact breaker gap and refit the distributor. Replace the manifolds and couple up the carburettor controls and petrol feed.

Two points should be checked at this stage. First make sure that the saw cuts at the cylinder block end of the inlet manifold (the centre ports) are clear of any obstruction such as jointing compound which would upset carburation. Jointing compound or gasket cement is not required, and all that is necessary is even tightening down of the four holding-down washers and nuts.

Secondly the starting control cable must be reconnected with sufficient "slack" to obviate the starter valve being lifted off its seat when in the fully released position due to normal movement of the engine on its rubber mounting.

Fit the generator and its attendant parts.

If you experience difficulty in bringing the exhaust pipe up to the position jack it up with the jack in the tool kit, taking care not to strain or dent the exhaust pipe. In replacing the clamp, see that the plain bevelled portion surrounds the manifold outlet and the numbered bevel is underneath, surrounding the silencer inlet pipe. If the clamp is fitted in the reverse manner, the silencer inlet pipe will not be drawn up tightly against the manifold outlet and an exhaust gas leakage will result.

Re-fill the radiator and put half a gallon of flushing oil in the engine. Run it at a fairly brisk tick-over for about ten minutes

and drain off the flushing oil. Re-fill with $\frac{3}{4}$ gallon engine oil and run the engine until it is thoroughly warm. Then check over the cylinder head and manifold nuts and the valve chamber cover screws which, once the engine has warmed up, can usually be given a further fraction of a turn. Lubricate the bonnet hinges and replace the bonnet. The car is now ready for the road.

After it has been run approximately 300 miles and just after it has come in from a long run and the engine is still hot, again check the tightness of the cylinder head nuts.

CHAPTER V

MAJOR ENGINE OVERHAULS

MAJOR engine overhauls, such as removing the pistons and connecting rods, reconditioning the crankshaft and camshaft bearings, or attention to the timing gears, should be regarded as the province of the Ford dealer, who is equipped with the necessary tools and has the experience of the factory behind him.

New Engines for Old. The Ford Motor Company operate a novel and very useful engine exchange scheme. After a very big mileage has been covered a general reconditioning and overhaul of the engine becomes necessary. In the ordinary way the car is taken to a dealer with instructions for a general overhaul, but it is sometimes difficult to obtain a precise estimate for repairs, and naturally the car must be laid up for at least a week, possibly several weeks. Under the engine-exchange scheme, however, it is possible to take the car to a Ford dealer and drive away with a reconditioned and guaranteed (six months) engine a few hours later. The price is very reasonable, and a reconditioned engine will prove an economy in the long run.

Nevertheless, occasions sometimes arise when it is impossible to take advantage even of the world-wide Ford service. Under these exceptional conditions, when the owner himself must tackle the work, possibly with skilled assistance if his own mechanical knowledge is insufficient, the following notes should enable the work to be carried out satisfactorily.

Since the information is intended for the mechanically-minded, a knowledge of workshop practice is assumed.

Removing the Pistons and Connecting Rods. The pistons and connecting rod can be withdrawn, after dropping the sump, without removing the engine from the chassis. The big ends will pass through the cylinder bores so that the pistons may be withdrawn upwards.

The Pistons. Before the gudgeon pins can be removed from the pistons, each piston, less its rings, should be immersed in boiling water for about one minute. The piston bosses must then be supported while the gudgeon pin is tapped with a suitable drift until a groove at the centre of the pin is freed from a circlip fitted in the little end bush. Once this is free, it should be possible to press the gudgeon pin out by hand.

On no account should the pins be driven out without heating the pistons; the result will be scoring of the piston bosses and a

slack fit on reassembly, leading to little-end bearing tap. If, on the other hand, the pin is a slack fit in the piston when the parts are cold, renewal of the pin, the piston, or probably both, is required.

On reassembling the piston to the connecting rod, each must be heated for a minute in boiling water before the gudgeon pin, well smeared with oil, is fitted. Ahead of the pin must go a tapered pilot pin which will expand the circlip in the little end bush, to allow the gudgeon pin to pass through it. The gudgeon pin should be pressed in until the circlip is heard and felt to click into place in its groove.

The pistons are of the split-skirt type. Although there should be a nominal clearance of 0·005 in. between the skirt and the cylinder wall when cold, it is difficult to measure this accurately due to the springy nature of the skirt. Consequently the manufacturers recommend the use of a strip of feeler gauge material half an inch wide, which should be inserted between the thrust side of the piston and the cylinder. An appreciable pull should be required to withdraw the feeler strip; this, measured by a spring balance, should be from 5–7 lb. on earlier engines and from 7–10 lb. on the latest models.

The piston ring gaps should be from 0·006 in. to 0·009 in., while the vertical clearance of each ring in the groove should be 0·0015 in.

Connecting Rod Bearings. In the earlier engines the connecting rod bearings are of the directly-metalled type, provision for taking up wear being made by fitting shims between the bearing cap and the rod.

One or more shims may be removed from each side, but on no account should the caps be filed or rubbed down. A radial clearance of 0·002–0·003 in. is specified, and the bearings should not be scraped in. The rod should just fall under its own weight when the bearing caps are fully tightened. If removal of all the shims is insufficient to remove all shake, the bearings should be remetalled, or preferably exchanged for remetalled rods, obtainable from the manufacturers.

On the later models thin-shell, steel-backed bearings are fitted. Replacement of worn bearings is thus a very straightforward job, but the bearings should on no account be scraped in, nor should the connecting rod caps be filed.

If the crankpins are scored, a re-ground crankshaft can be obtained from the manufacturers.

The Main Bearings. The crankshaft of the earlier engines runs in white-metal bearings, the metal being cast directly into the bearing caps and housings. As most experienced mechanics will be aware, it is seldom satisfactory to attempt to take up the

main bearings: instead, the crankshaft should be reground if there is any appreciable ovality on the pins and journals, and the bearings should be remetalled and bored in line, the diameter being chosen, of course, to suit the undersize journals.

On later engines, however, thin-shell bearings are fitted to the

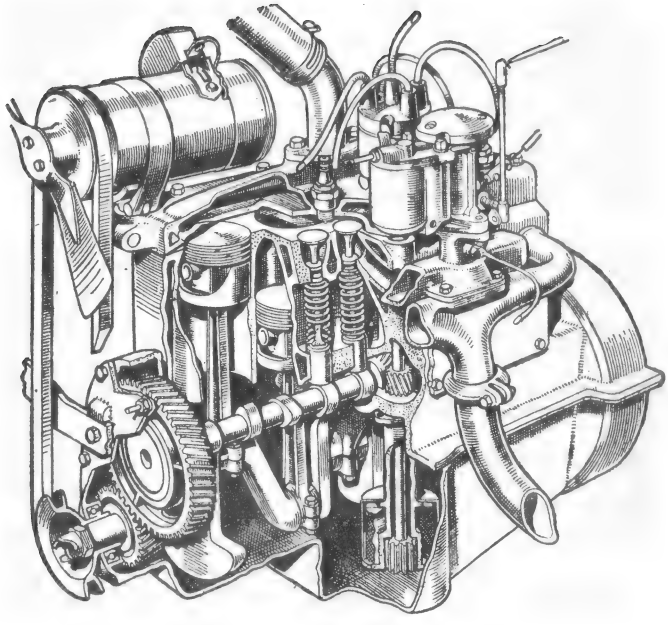


FIG. 17. PART SECTIONAL VIEW OF THE ENGINE

Notice the drive from the camshaft (by skew gear) down to the oil pump and up to the distributor, and the balance weights on the crankshaft

crankshaft, so that it is possible to renew a bearing without removing the crankshaft from the engine. The cap of the bearing to be dealt with should be removed, and the nuts on the other bearing caps slightly loosened. A specially-shaped copper pin is then inserted through the lubrication hole of the journal so that it will bear against the lip of the bearing shell, opposite to the locating tongue. On rotating the crankshaft, the pin will thus push the shell round out of its housing, locating tongue first.

Replacement is simply a matter of reversing the operation. Two points should be borne in mind, however. In the first place,

make sure that the replacement shells are of the correct diameter: the crankshaft may have been reconditioned, calling for undersize bearings. Secondly, see that the shell in which a lubrication hole is drilled is fitted to the crankcase and not to the cap; otherwise, lubrication of the journal will be non-existent.

The rear main bearing controls the end-float of the crankshaft; the bearing chosen should have about 0·006 in. end clearance.

The Timing Gears. The maximum backlash on the gears fitted to earlier engines should be 0·004 in. Oversize wheels are available. The camshaft gear is pressed onto the camshaft, and a special locating jig must be used when fitting a new gear in order to obtain the correct position of the gear relative to the cams. Although chisel marks show the position of the gear on the camshaft, if the jig is not used, the timing may be slightly altered, with adverse effects, of course, on the performance of the engine.

On later engines the camshaft is driven by a duplex roller chain which requires no adjustment. When it eventually becomes slack it should be renewed.

The Distributor and Oil Pump Driving Gear. If the distributor and oil pump driving shaft is removed, the skew gear must be correctly meshed with the gear on the camshaft. Insert the lower end of the distributor drive gear slightly into the cylinder block location, line up the dowel hole in the sleeve with that in the boss at the bottom of the valve chamber, and turn the offset tongue at the upper end of the gear, until it forms an angle of approximately 45 degrees with the cylinder front cover and with the *broader shoulder* is to the rear of the cylinder block.

Push the drive gear into the cylinder block location until both dowel holes are in alignment and replace the dowel, tapping it in carefully until it is flush with the side face of the cylinder block. Replace the distributor coupling shaft, ensuring that the end slot locates with the tongue at the upper end of the distributor drive gear.

Looking at the upper end of the coupling shaft, the *small shoulder* and not the broader shoulder should now be to the rear of the cylinder block; this is due to the fact that the two slots are offset on opposite sides of the diameter.

The distributor may now be replaced, care being taken to ensure that the offset tongue at the bottom of the drive shaft engages correctly with the offset slot at the top of the coupling shaft. The ignition timing should now be checked as described on page 64.

CHAPTER VI

THE COOLING SYSTEM

THE cooling system needs but little attention. Daily check the water level. Use only clean water. If it is insufficiently clear for drinking purposes there is dirt in it which will deposit on the inside of the water jackets and interfere with the cooling. If possible fill with rain water or other soft water as this does not "fur up" the cooling system as some hard waters do.

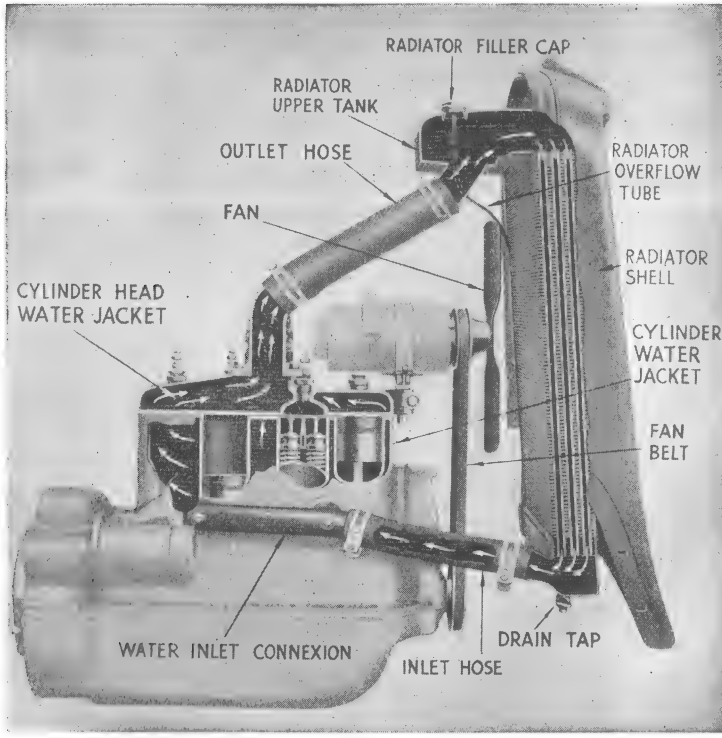


FIG. 18. ILLUSTRATING THE THERMO-SIPHON COOLING SYSTEM
But for the shape of the Radiator Shell there is no difference in the cooling systems of the De Luxe and Ten Models

Cleaning the Cooling System. Once every 5000 miles, or more frequently if hard water is used, flush out the cooling system. To do this open the drain tap at the bottom of the radiator, under its cover (see Fig. 18). Insert a hose in the filler orifice and allow the water to run into the cooling system until that which comes out of the drain is clear. Turn off the hose and allow the water in the cooling system to drain away. Close the drain tap

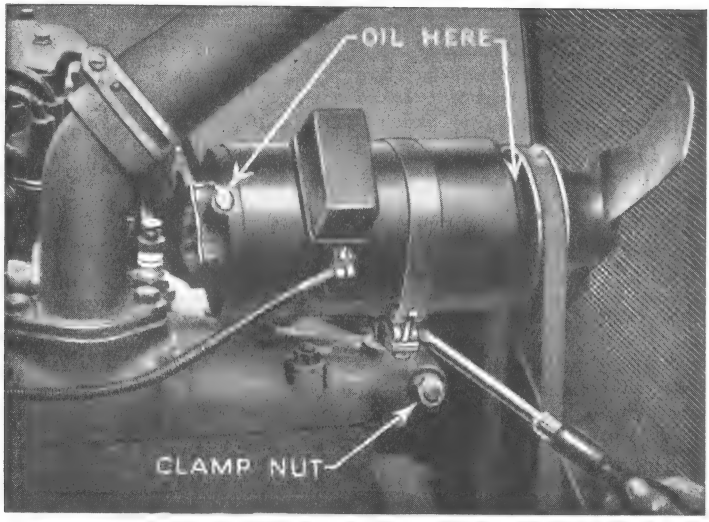


FIG. 19. RETENSIONING THE FAN BELT
The oiling points shown above do not apply to current models

and refill the cooling system. The tap handle is horizontal when the tap is closed.

Winter Care of the Cooling System. If frost is suspected drain the radiator and hang a card on the steering wheel with the words "No Water" printed on it to warn any person against starting the engine until the radiator is refilled. Always make sure that the drain tap is closed before starting the engine after filling the radiator. The radiator should always be drained if the car is stored in winter.

If the car is used in winter, in regions where frosts are fairly frequent, and if it is stored in an unheated garage, add anti-freezing solution to the cooling system in the recommended quantities. Always purchase this from an authorized Ford dealer

as some compounds, while they prevent freezing, have a corrosive action or cause deposits to form. Radiator glycerine is perfectly safe to use. This is generally a 60 per cent concentrated glycerine solution. Two and a half pints in the radiator will resist 6° F. of frost and four pints will resist 10° F. of frost, which should be sufficient for any part of Great Britain where the car is not stored in an exposed place.

As many of the proprietary anti-freezing solutions contain alcohol take care not to spill them on the paintwork or they will damage it. Partially empty the radiator before adding the solution and then top up with the remainder of the water, taking care not to overfill the radiator to avoid loss of solution.

Adjusting the Fan Belt. The fan belt should not be adjusted unless it slips. This will not occur until the belt has at least 4000 miles to its credit. The correct adjustment is when the belt is alternately pushed and pulled, midway between the two pulleys, and the total movement does not exceed 1 in.

To adjust the belt unscrew the nut on the taper clamping pin about three turns. Tap the screwed end of the pin lightly, using a wooden drift to avoid damaging the thread, so as to release the taper. The generator can then be prised upward with a screwdriver or the tyre lever supplied in the kit (see Fig. 19). Do not forget to tighten the clamping nut after adjustment.

Water Pump and Fan. In order to provide adequate cooling in tropical and semi-tropical countries, a water pump is available and can be fitted by Ford dealers. In addition, a four-bladed fan can be fitted when required. This may provide sufficient additional cooling without the use of the pump. Conversely, in cold climates, when an interior heater is needed to maintain a comfortable temperature within the car, the fitting of a water pump will greatly improve the efficiency of this invaluable accessory.

Causes of Overheating

(1) No water in the radiator.

(2) Fan belt slipping.

(3) Oil level too low in the engine. Add oil to bring level up to the "F" or "Full" on the dip-stick.

(4) Over-driving uphill in summer weather may cause a little temporary boiling, but this is of no account.

(5) Engine needs decarbonizing.

(6) Car is being run with the starting control in use.

(7) Inferior oil.

(8) Ignition timing has been interfered with and the spark is wrongly timed.

(9) Driving with the hand brake partially on. Hand brake must be pushed off to the full amount.

(10) General loss of tune caused by prolonged neglect, the use of inferior fuel and oil, and rank bad driving.

(11) Driving with the radiator muff closed in winter after the engine has warmed up from cold.

(12) A new car will boil if it is driven too hard, even though it has just concluded its initial 500 miles. The cure is to reduce your speed a little for a hundred or so more miles until the engine is absolutely free.

If the radiator boils and steam is seen issuing from the vent pipe in the near side bottom corner of the radiator wait until the boiling stops before removing the radiator cap or you may get badly scalded. Allow the engine to cool off a little before adding water and then do so very slowly, as a sudden rush of cold water on to the hot cylinder heads may crack them.

CHAPTER VII

THE ELECTRICAL AND IGNITION SYSTEMS

THE electrical system of all Ford Ten models is the 6-volt, earth return type with positive earth.

Care of the Battery. Every two weeks check the electrolyte in the battery to see that it is at the proper level, which should be ⅜ to ½ in. above the top of the plates. Use only clean, DISTILLED water. Before removing the battery-filler plugs wipe the top of the battery over with a dry rag, for the importance of cleanliness in this operation cannot be over-emphasized. Do not add more water than is required to bring the liquid ½ in. above the plates, for the liquid expands when the battery warms up to its work and the excess is forced through the vent holes in the filler caps. Besides causing a loss of valuable acid this overflowing sets up corrosion of any metal with which it comes into contact.

In cold weather add the distilled water just before going out for a run, as the charging will mix the electrolyte and prevent freezing. Excessive use of water by the battery is usually an indication of charging at too great a rate and the generator should be adjusted to conform more nearly with your electrical requirements. (See page 56 for method of adjustment.) Anything more than a tablespoonful of water per cell per fortnight must be regarded as excessive consumption.

The specific gravity of the electrolyte (mixture of acid and water) is an indication of the state of charge of the battery, and should be checked with a hydrometer. The correct specific gravity is 1·270 to 1·290 at 70° F. Subtract 0·004 for an increase in temperature of 10° F. or add 0·004 for a decrease of 10° F. If the level of the electrolyte is low, no attempt should be made to take a reading after adding distilled water, until the battery has been on charge for at least an hour. This is to ensure that the acid mixes thoroughly with the water to form a uniform mixture. If the specific gravity of the acid is found to be low, the battery should be charged, preferably by your Ford dealer.

Avoid charging the battery at an excessive rate. Ten amperes may be regarded as a safe maximum except when automatic charging control is fitted, when the charging rate may reach 30 amperes if the battery is discharged. The battery should not be allowed to become unduly discharged. If the lights dim more than just a small amount when the starter is used, or if the starter is sluggish in action, it is an indication that the battery

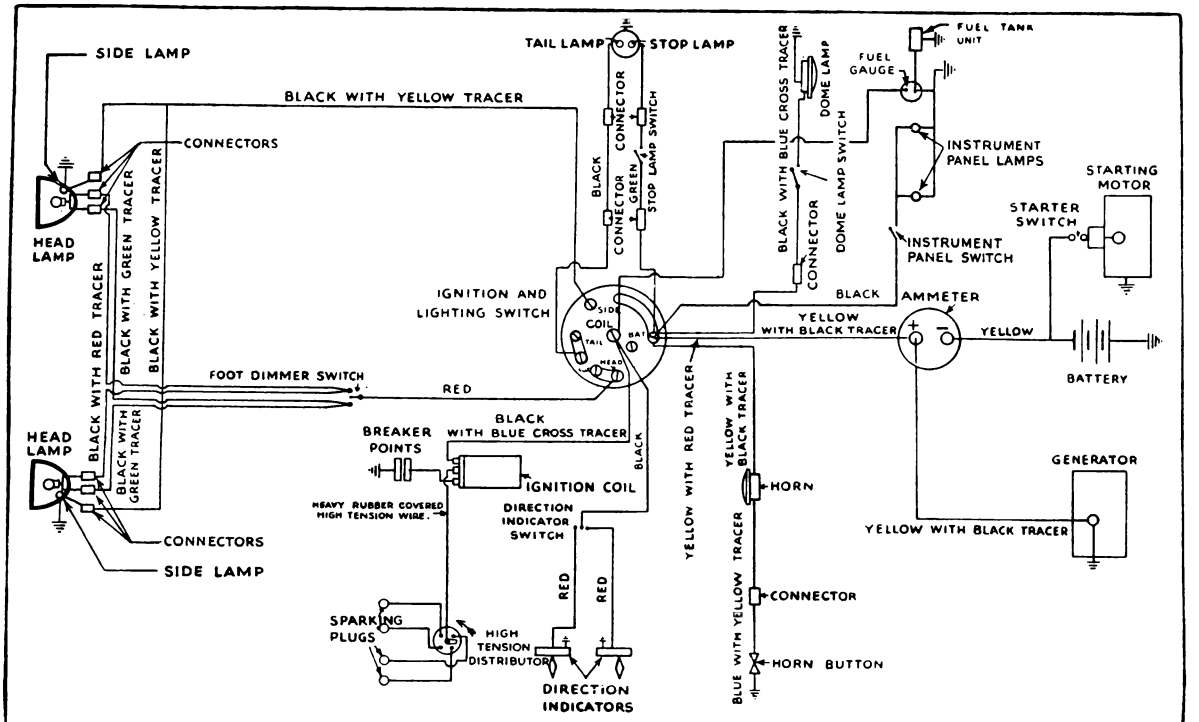


FIG. 20. THE DE LUXE WIRING DIAGRAM

Separate wing lamps are used on the De Luxe models prior to 1937, these being fed by the black wire with the yellow traces

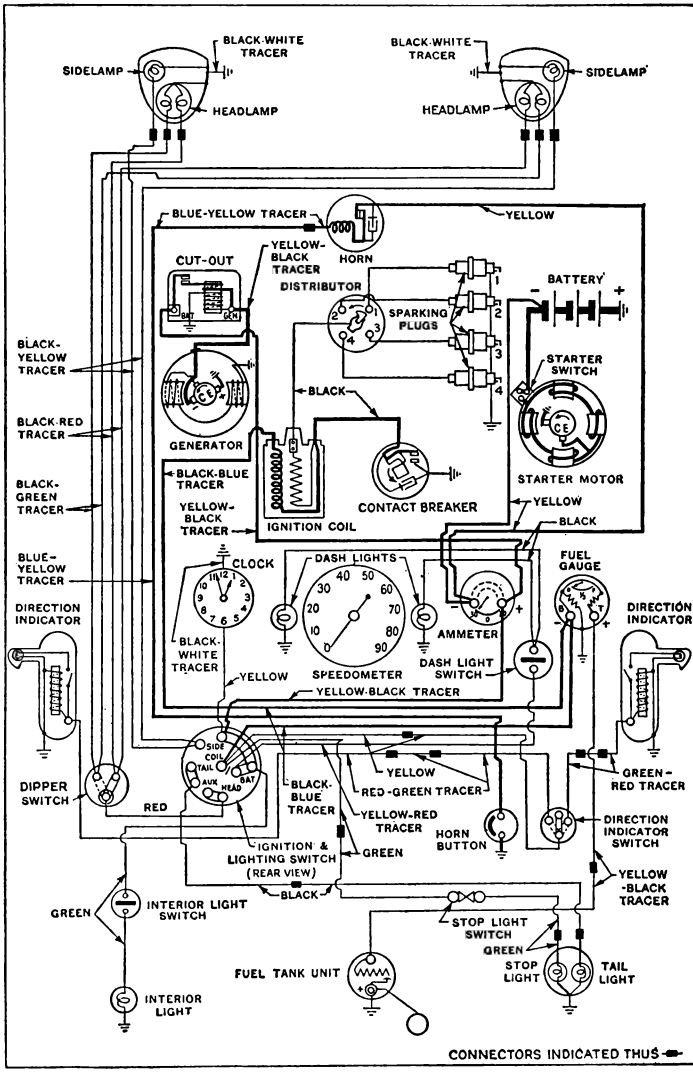


FIG. 21. WIRING DIAGRAM (3 BRUSH GENERATOR)

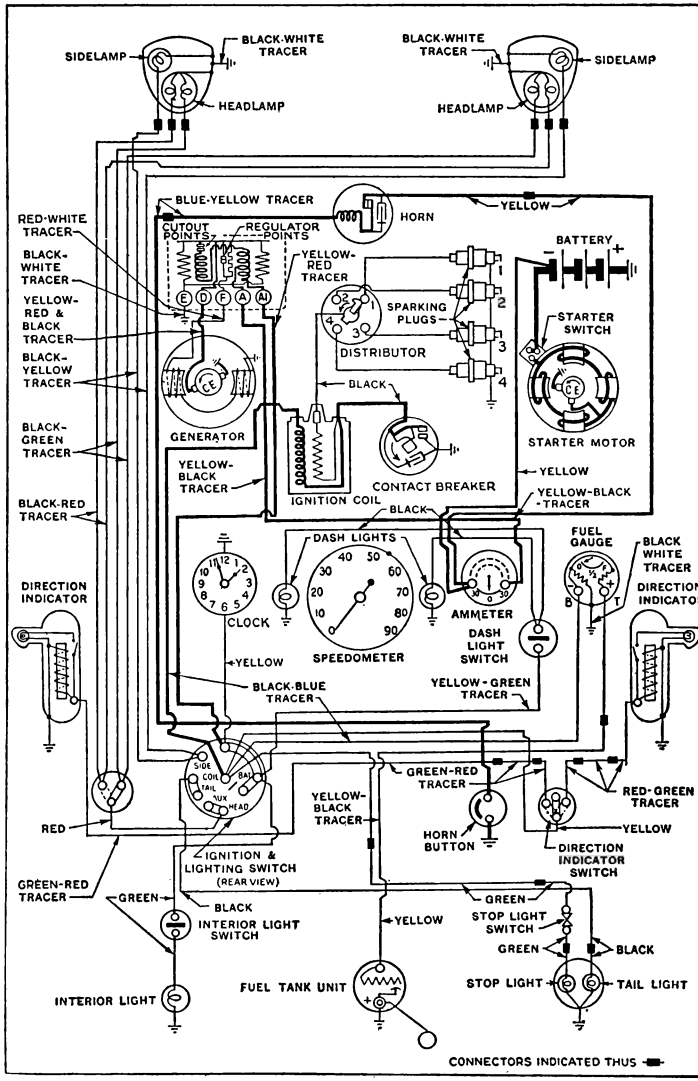


FIG. 22. WIRING DIAGRAM (2 BRUSH GENERATOR)

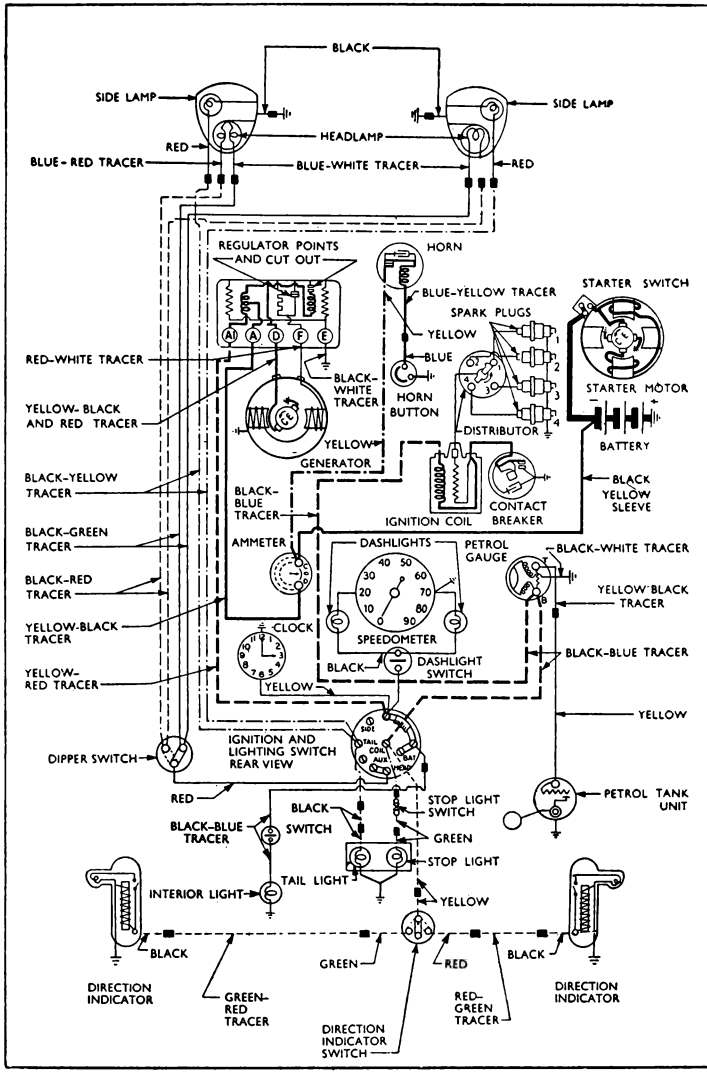


FIG. 23. WIRING DIAGRAM (POST-WAR MODELS)

is in a run-down condition. Remove immediately and have it re-charged, unless you are going on a lengthy daylight run, on which it will charge itself. Allowing the battery to stand in a run-down condition shortens its life.

Always install the battery with the POSITIVE terminal EARTHED. See that the battery top is kept clean and that the terminals, including the earth connexion with the dashboard, are tight. Cover the battery terminals with petroleum jelly to protect them against corrosion.

Electrical Connexions. Loose or corroded battery connexions increase the line resistance, raising the voltage of the generator often beyond the capacity of the light bulbs, causing them to burn out, and the contact points to pit and burn. Loose ignition connexions give rise to "missing" and difficult starting. The black, rubber-covered, high-tension wires, connecting the coil with the distributor and the distributor with the sparking plugs, are held in position by snap fasteners at their ends. Make sure that the wire is well home in its socket.

Insulators. Periodically wipe the top of the battery, the sparking-plug insulators, the insulated end of the coil, the distributor cover and the high-tension leads with a clean rag, for the dirt on them forms a track for the current and leads to short-circuiting and "missing," particularly at high speeds.

The Generator. This should be lubricated as described on page 27. Every 5000 miles or so, slip back the steel band covering the holes in the casing at its rear end, remove the belt, and while holding a clean piece of non-fluffy rag against the commutator rotate the fan to clean the commutator. Replace any worn brushes. Take care not to move the upper of the brushes, as this will vary the charging rate.

On two-brush generators with automatic control, there is no cover band, and the generator must be dismantled if the commutator or brushes need attention. This is normally a job for a Ford dealer.

Varying the Charging Rate. To increase or decrease the charging rate on three-brush generators, slip back the wide steel band that encircles the rear of the generator and move the uppermost brush. To increase the charging rate move the brush in the direction of rotation; to reduce the rate move it in the direction opposite to that of rotation. Move the brush not more than $\frac{1}{16}$ in. at the time and check the charging rate by speeding up the engine gradually and watching the ammeter. For average driving the winter charging rate should not exceed 10 amps.; 6 amps. will be found suitable if long daylight runs are indulged in in summer. On automatically-controlled systems it is best to let a Ford dealer adjust the regulator.

The Starting Motor. The starting motor needs practically no attention. It requires no lubrication as the bearings are grease-packed during manufacture.

When the Starter Jams. Starter jamming may be caused through a bent starter spindle, the starter being loose in its housing, damaged teeth on the starter ring on the flywheel, or dirt on the screwed shaft of the Bendix drive.

The starter may be freed by engaging TOP gear and, with the ignition switched off, giving the car a smart jerk FORWARDS. If difficulty is experienced the starter should be removed. To do this uncouple the EARTH lead from the battery, disconnect the lead at the starter, and uncouple the starter-control wire at the starter end. On the later models, the two long screws that go right through the body of the instrument holding it together, also attach it to the engine.

Clean with petrol all the dirt off the screwed shaft on which the starter pinion slides. Dry the screw and re-fit the starter with the screw dry. Make certain that the screws that hold the starter in position are done up tight.

The Lamp Bulbs. Use only genuine Ford lamp bulbs. These are of the 6/8 volt type. The side lamps, dash light, and the interior body light all use single-contact bulbs of 3 watts, except on post-war models, which have a 6 watt bulb (festoon type) in the interior light. The head-light bulbs are of the double-filament type, the major filament on earlier models being 32 watts while the "dip" filament is 21 watts. On later cars both main filaments are 24 watts: when the lights are "dipped," both head-lamp beams are deflected downwards, the bulb filament in the left-hand head-lamp being 24 watts and in the right-hand side 3 watts. On post-war cars the left-hand bulb has two 36 watt filaments, and the right-hand bulb a single 36 watt filament. When replacing head-lamp bulbs make sure that the word "top," which is stamped on the base of the bulb, is uppermost.

The combined "stop" and tail light has two filaments, the tail light being 3 watts, and the "stop" light 18 watts. Should the tail-light filament give out the bulb can be reversed and the 18 watt filament can be brought into use as a tail light. As this filament takes six times as much current out of the battery as the normal tail light the bulb must be changed at the earliest opportunity. When fitting a new tail-lamp bulb make sure to do so with the word "Top" stamped on the base of the bulb, at the top.

Focusing and Aligning the Head-lamps. Focus and align the head-lamps with the car empty, standing on a level surface in front of a white wall. The wall must be 25 ft. in front of the head-lamp lenses and the front of the car must be exactly parallel with the wall. The easiest way to achieve this result is to run

the car into the corner of a courtyard where there are two walls at right angles. If the side of the car is parallel with one of the walls its front will be parallel with the other. The parallelism can be easily checked by measuring the distance from the centre of the hubs of the front and rear wheels to the wall alongside them.

Mark out the wall in the manner shown in Fig. 24. The vertical centre line should be in the centre of the car, the horizontal centre line 33 in. from the ground and the two lamp centre lines should be, in the case of the De Luxe model, 14 in. each side of the car centre line, and in the case of the Ten model, 19¼ in. each side of the car centre line. On post-war cars the measurements are 30½ in. and 21 11/16 in.

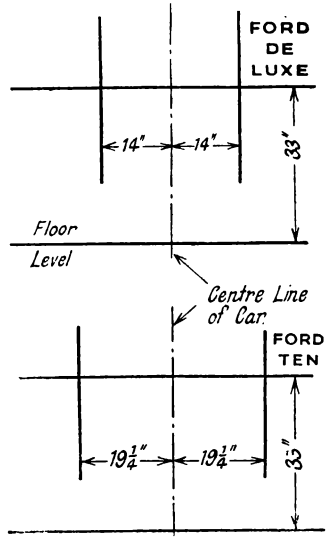


FIG. 24. WALL MARKING FOCUSING AND ALIGNING HEAD-LAMPS

Cover one head-lamp to obscure the rays, and switch on the "normal" beam. Focus the beam by turning the screw in the centre of the back of the lamp in or out until you have as well defined a circle of light as possible, or by adjusting the bulb in the reflector on later models.

The lamps are held in position by a nut within the support, which can be reached by a special slotted tube spanner from underneath the mudguard. Slack this off a turn or so and align the lamp so that the centre of the beam coincides with the point where the vertical line intersects the horizontal line (see Fig. 24). Tighten the nut that holds the lamp to its bracket and then cover it to obstruct its rays. Proceed to focus and align the other head-lamp.

On recent cars the horizontal and vertical adjusting screws will be seen in the flange of the reflector when the lamp rim and rubber sealing ring have been removed. On these models the reflectors are sealed, and head-lamp bulbs are replaced by first removing the lens and sealed reflector as a unit. This is done by releasing the clip at the base of the head-lamp lens rim and pulling the rim and lens outwards and upwards. The bulbs are then removed from the rear.

A Head-lamp Tip. There are no separate side lights on the Ford Ten, the parking lights are small bulbs fitted in the top of the

head-lamps. The lighting arrangement is such that when the head-lamp bulbs are switched on, the parking bulbs are extinguished. Hence the head-lamps must not be used unless both are in working order. If, for instance, the off-side dip filament is broken, the off-side lamp will be in darkness, when the beams are dipped, and there will be nothing to indicate the width of the vehicle. Should you be caught out with a defective off-side head-lamp bulb, put it in the near-side lamp because, as long as the off-side lamp functions perfectly, there is no risk of head-on collision. Alternatively, the roof light may be used.

To make the parking lamps work all the time that the tail-light is in use, detach the black with yellow tracer wire from its terminal at the back of the dash switch, and put it on the "tail" terminal. This will cause the parking bulbs to burn all the time that the lights are in use, irrespective of whether the switch is on the "head" or "side" position. When it is turned off, all lights naturally are extinguished. Connecting up the wiring in this fashion makes slightly greater demands on the battery.

Tracing Electrical Troubles

If the car stops as though the ignition has been switched off, make sure that you have not inadvertently turned the switch key. Try the lights and the horn. If the whole of the electrical system is dead, and no electrical unit will operate, it is not unlikely that one of the battery leads has become disconnected. Examine the battery connexions and also the fixing of the other end of the earth lead, where it is bolted to the dashboard.

If a battery, which has been properly cared for, loses its charge rapidly examine the electrical system for short circuits. To some measure the ammeter will assist in detecting these. Switch on each piece of electrical apparatus in turn and watch the behaviour of the ammeter needle. If it swings over unusually far to the discharge side when a certain unit is in operation there is a short circuit in the wiring leading to that unit. Trace it throughout its length, looking particularly for bare places where the insulation has become worn and chafed. Place a small piece of tyre patch over the bare place and bind it into position with insulation tape.

If a lamp fails examine first the bulb and try it in another holder to see if it works. If it is in sound order look for broken or dirty connexions. Flickering lights arise from loose or dirty connexions.

If, through inadvertently garaging the car overnight with some of the lights burning, the battery becomes so discharged that it will not turn the starter, observe the lights. If there is the merest red glimmer there is sufficient current to start the engine

with the handle. Once you have got it going keep it turning sufficiently briskly to rotate the generator at charging speed. Avoid use of the electric starter, lights, horn, or traffic indicator. At the earliest opportunity take the battery to an authorized Ford dealer to have it charged, unless you have before you a succession of long daylight runs. Even then avoid use of the

FIG. 25. SETTING THE SPARKING PLUG GAP

electric starter and other electrical equipment for several days to give the battery the maximum opportunity of recuperating.

If the battery gradually loses its charge, particularly in winter, the trouble may often be remedied by increasing the charging rate of the generator.

THE IGNITION SYSTEM

Sparking Plugs. Sparking plugs of 14 mm. type are standard to this car and they cannot be improved upon for performance. Difficult starting or misfiring is sometimes caused by dirty plugs. Set the plug gaps to 0·022 in. using the 0·022 in. feeler supplied in the tool kit. Never attempt to bend the centre electrode, as in doing so you will certainly crack the insulator. Set the gap by bending the outside electrode. This work will be facilitated by using the gap tool which is obtainable from the plug manufacturers. The model of this small combined wrench and gauge suitable for this type of car costs only a few pence.

The plug can be cleaned by scraping the metal portion of the

body with a knife and the porcelain insulator with a pointed stick. Do not use a knife on the insulator as it may damage the glazed surface. The best method is, however, to have the plugs cleaned on the sand blast cleaner with which all Ford dealers

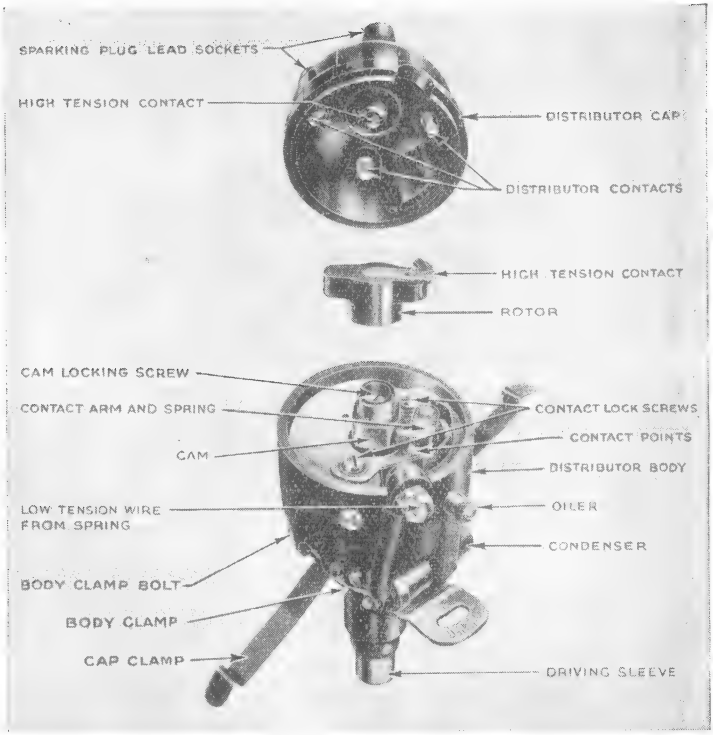


FIG. 26. SHOWING THE PARTS OF THE FORD DISTRIBUTOR AND CONTACT BREAKER

The distributor cap and rotor have been lifted off to show the interior details

are now equipped. The usual charge for cleaning and adjusting a set of plugs is 2s.

Never re-fit a plug without its copper and asbestos washer, or the gas will leak round the plug thread. Plugs do not last for ever. In time the centre electrode becomes eroded away. There is, however, no need to change them at intervals of less than

10,000 miles, and if you do not drive hard all the time, and use good quality oil, they will sometimes last as long as 14,000 to 16,000 miles.

Adjusting the Contact-breaker Points. It will be found that the contact-breaker gap becomes considerably reduced during

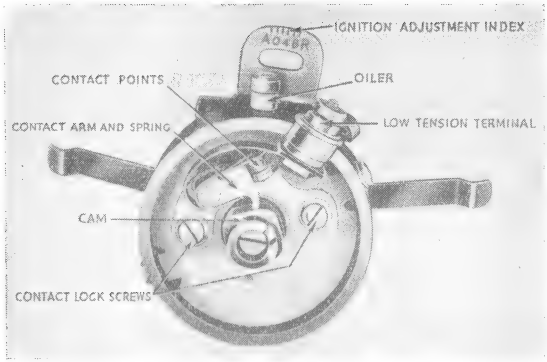


FIG. 27. SHOWING DETAILS OF CONTACT BREAKER

the first 1000 miles, when adjustment is necessary. If, however, the cam is covered with a VERY THIN film of petroleum jelly to lubricate the fibre block on the breaker arm it will wear very slowly and attention will be required only at infrequent intervals.

Examine the points. If they are burnt or pitted they should be dressed up with an oil stone. DO NOT USE A FILE. The best plan, however, is to fit a new pair of points, as the cost is very moderate. Badly burnt or pitted points are usually an indication of condenser trouble or a poor battery connexion. It may also be caused by running the car with the points set at too close a gap.

Lift off the distributor cover and rotor (Fig. 26), and turn the engine over with the starting handle until the fibre block rests squarely on the TOP of one of the humps of the cam. Make certain that it is in this position, for the points are then FULLY open and if the adjustment is made with the points in any other position it will be wrong.

On the earlier De Luxe models, the adjustment is effected by turning the contact point. Loosen the contact lock screws and adjust the points to give a gap of 0·018–0·020 in. (18–20 thousanths of an inch).

The adjustment is slightly different on the type of breaker shown in Fig. 27, which is fitted to the later models; the plate on

which the rocker arm is mounted must be moved until the clearance is correct. Do not forget to tighten the lock screws. The correct gap is 0·010 in. to 0·012 in.

Timing the Ignition. The ignition timing is set to give the best all-round results before the car leaves the factory, and it should not be interfered with in the ordinary way. So many owners believe that by giving extra advance they are getting more power because the engine runs more harshly. To compensate for differences in fuel it may be desirable to vary the ignition a trifle. To advance the spark on the type of distributor shown in Fig. 26, which is fitted to all but the first series of the De Luxe models, loosen the screw that attaches the ignition adjustment index to the cylinder head, and rotate the distributor slightly in a clockwise direction, looking down on to the top of it. To retard, move the distributor in the opposite direction. On the earlier De Luxe models slacken the body clamping screw and move the distributor body and cover SLIGHTLY in a clockwise direction, looking down on to the top of the distributor, that is, opposite to the direction of rotation of the cam. To retard the ignition, move the distributor in an anti-clockwise direction looking down on to the top.

Only a very slight amount of movement is necessary, for each graduation represents 2° of distributor movement, which is equivalent to 4° on the crankshaft. Be sure to tighten the clamping screw after adjustment.

The distributor unit can be lifted off the cylinder head, by removing the screw that attaches the end of the body clamp to the cylinder head, without disturbing the timing. If, however, the distributor is lifted out of the body clamp, the distributor cam is moved on its shaft (cannot occur on a later type), or the driving gear on the camshaft is disturbed, it will be necessary to re-time the ignition in the following manner—

Having checked the contact-breaker gap unscrew the timing pin from the timing-gear cover and insert its plain end into the hole from which it was removed. Turn the engine over SLOWLY with the starting handle, at the same time pressing the timing pin in. When No. 1 piston has reached the correct position for timing the ignition the pin will drop into an indentation in the camshaft gear.

Slacken off the body-clamp bolt and turn the distributor until the condenser is facing the engine. Tighten the body clamp nut just sufficiently to prevent the distributor being moved inadvertently. Slacken off the cam locking screw sufficiently to allow the cam to be rotated on its shaft. Replace the rotor on the cam. (This is only possible on early type distributors. Later types must be set with rotor at No. 1 contact and if drive is disturbed this

must be set to give this condition.) Turn the cam in an ANTI-CLOCKWISE direction to take up the back-lash in the drive, until the contact point on the rotor points to the No. 1 contact on the distributor and the contact breaker points are JUST commencing to open. Tighten the cam locking screw and the body clamp nut.

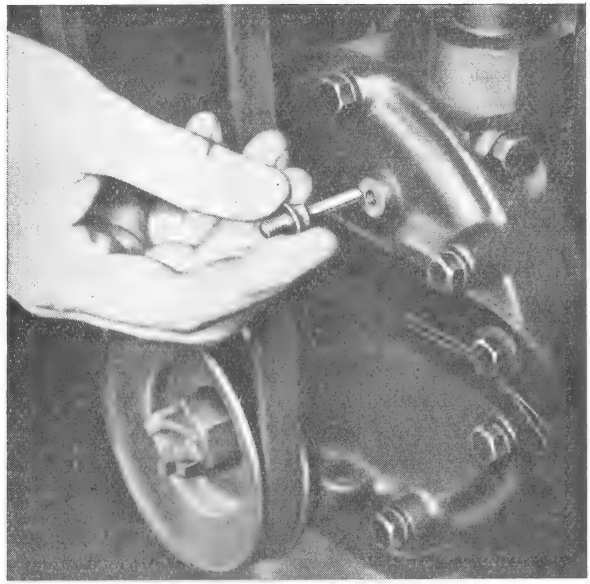


FIG. 28. THE TIMING PIN WHICH INDICATES TOP DEAD CENTRE

Withdraw the timing pin and switch on the ignition. Slowly rotate the engine with the starting handle and re-insert the timing pin in its hole. Continue turning slowly until the timing pin again drops into the indentation in the camshaft gear, when a spark should occur at the contact-breaker points.

If no spark occurs when the pin drops into its indentation some error has been made and the timing must again be checked. Slight errors in timing may be rectified by loosening the distributor-body clamp nut and twisting the distributor body a little in the requisite direction. After each movement tighten the clamp nut and check the timing with the timing pin.

Firing Order. The firing order is 1, 2, 4, 3—number 1 being the front cylinder.

Ignition Trouble. Misfiring may be caused by dirty plugs, wrongly set plug gaps and, if it comes on above a certain speed, by wrongly set contact-breaker points. It is indicated by loss of power and the uneven beat of the exhaust. Run the engine slowly and "short" each plug in turn with the screw-driver. Hold this tool only by the wooden handle and bring it into contact with the cylinder head before touching the plug.

If, on touching one of the plugs, the missing is not increased, that is the faulty plug.

If the rest of the electrical circuits are functioning properly but only the ignition is at fault proceed as follows.

(1) Disconnect the black high-tension wire from the coil to the distributor end by pulling it out of its holder.

(2) Switch the ignition "on."

(3) Dab the metal cap on the end of the wire sharply on to one of the cylinder-head nuts. If no spark occurs check each wire for a broken or loose connexion.

(4) If a spark does occur see that the coil to distributor wire is making good contact at both ends, examine the contact-breaker points and gap, and also the plug points and their gaps.

The next test will conclusively determine whether the ignition coil, contact-breaker points, condenser, and low-tension circuit are in good condition. Remove the end of the main high-tension lead which runs from the coil to the distributor cap, at the point at which it enters the cap. Take off the cap itself, so that the contact-breaker mechanism is exposed. See that the contact-breaker points are in contact with one another, if necessary rotating the engine until they close.

This, incidentally, will immediately reveal faults such as a stuck rocker arm which carries the movable point, caused by the fibre of the arm swelling and binding on the pivot pin. It may be necessary slightly to enlarge the hole, although lubrication with graphite from a lead pencil is often sufficient to cure the trouble. A broken rocker-arm return spring will also be obvious on inspection.

On the other hand, if the contact breaker appears to be in order, hold the bare end of the high tension lead $\frac{1}{2}$ in. away from an earthed metal surface, and flick apart the contact points. A good spark across the $\frac{1}{2}$ in. gap isolates the trouble in the "spark-distributing" components of the distributor. Conversely, lack of a spark indicates coil, contact-breaker, or low-tension circuit troubles.

CHAPTER VIII

THE CARBURETTOR AND FUEL SYSTEM

THE carburettor is automatic in action and will not require any attention provided that the filter in the fuel pump is kept clean. Should dirt or water enter the carburettor the float chamber must be removed by taking off the two float-chamber screws and lifting the float chamber off to give access to the jets. The location of the various jets is seen in Fig. 29, and they can be removed with a screwdriver. Never use a pin or piece of wire to clean the jets or you will damage the accurately calibrated hole. It is advisable to blow the obstruction clear with the tyre pump as moisture from the mouth may clog the hole, which may be too small to pass water. There is a small air filter attached to the float chamber screw nearest to the cylinder head. Make sure that this is in position, for any dirt entering at this point will tend to clog the small passages in the emulsion block.

This block, which is the die cast plate held by three screws to the rear face of the float chamber and provided with the nozzle which projects into the carburettor venturi, must never be removed as it is most essential that it makes an air-tight joint with the float chamber.

Slow Running Adjustment. When the car is delivered the slow running is generally satisfactory but, as the engine frees itself during the running-in process, the idling speed becomes faster. Do not attempt to adjust the slow running until the car has done at least 500 miles and the starting handle test outlined on page 18 shows the bearings to be free.

The adjustments should be made when the car has just come in from a run and the engine is thoroughly warm. Proceed as follows: Turn the air-adjusting screw down until you feel it seat and then open it up three-quarters of a turn. Screw the throttle-adjusting screw out until it is clear of the throttle arm. Screw it in again until it JUST touches the arm. Then give it a further three-quarter turn to hold the throttle open a shade.

Now start the engine and turn the throttle-adjusting screw in or out a fraction of a turn so that the engine runs sufficiently fast to prevent it stalling. Then turn the air-adjusting screw in or out a fraction until the engine runs evenly. This adjustment may speed up the engine a little. If it is desired to slow the engine the throttle-adjusting screw should be turned out a fraction of a turn and then the air screw re-adjusted to suit. Never aim at

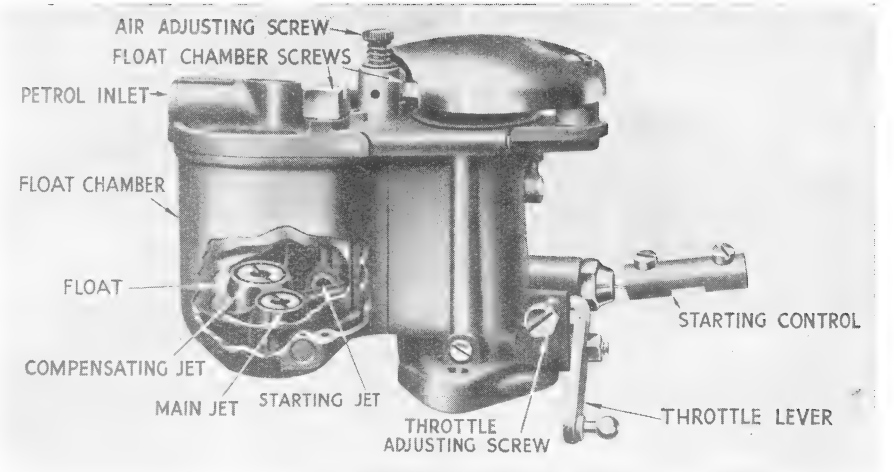


Fig. 29. The Ford Carburettor

All jets, except the slow-running jet, can be seen in the above illustration
Note the two slow-running adjusting screws

getting absolutely the slowest running speed, as the car is more satisfactory to handle if the engine is allowed to idle at a slightly higher pace.

The Fuel Pump. Every 5000 miles the bolt that retains the top cover of the fuel pump should be removed so that the filter gauze

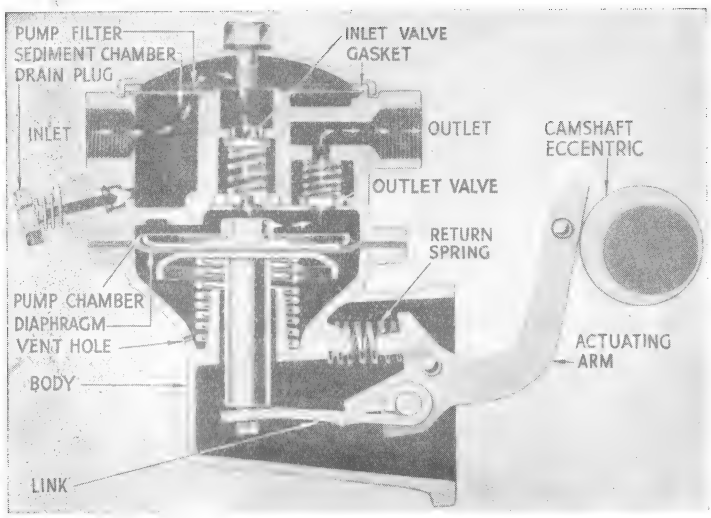


FIG. 30. SECTIONAL VIEW OF CAMSHAFT-DRIVEN FUEL PUMP

can be taken out and cleaned. When a drain plug is fitted to the sediment bowl, this should be unscrewed to allow sediment to be drained off. Otherwise, the interior of the bowl should be cleaned with the aid of a clean rag, free from fluff, wrapped around a small piece of stick. When refitting the cover make sure that the cork washer is in good condition and that the small washer is fitted beneath the head of the securing screw. An air leak at either point will put the pump out of action.

FUEL SYSTEM TROUBLES

Starting Difficulties. Starting difficulties may be caused either by the fuel system or the ignition system, but a more probable cause is the driver himself. Have you followed the instructions given in Chapter I? Have you been attempting to start a hot engine with the starting device in use? If you have, the cylinders

will be flooded with rich mixture. Switch off the ignition, push the starting device out of action, press the accelerator RIGHT DOWN, and spin the engine for three or four seconds with the electric starter to clear the rich mixture out of the cylinders. Then start in the normal manner.

Starting difficulties, especially if accompanied by erratic slow running, are sometimes caused by leakages in the tube connecting the inlet manifold with the windscreen wipers. If, however, the wipers function normally this cause need not be investigated, as any serious air leak will throw them out of action.

If your method of starting is correct see if petrol is coming through to the carburettor. If there is petrol in the tank, and the ignition is switched "on" and functioning properly, examine the float chamber by removing the float-chamber screws. If the float chamber is empty there are three possible causes, the first of which is the most probable, especially if the car has been left standing for a few days in warm weather. The causes are—

(1) Petrol in the carburettor has evaporated.

(2) It has leaked away through the joint between the float chamber and the emulsion block.

(3) The petrol is not reaching the carburettor.

As a check test uncouple the petrol pipe at the union on the carburettor. Remove the float chamber, fill it with petrol, replace it, and start the engine. Speed the engine up to a fairly brisk pace and observe the end of the petrol pipe. If all is well petrol should commence to gush from it within a few seconds. Stop the engine and reconnect the pipe and you will have no further trouble. If this trouble happens frequently, and after the engine has only been stopped for a few hours, tighten the carburettor emulsion-block screws.

If petrol does not gush from the pipe but the engine starts and runs on the fuel in the float chamber the fault lies in the petrol pump or pipes. Check the tightness of all the unions, particularly on the suction side of the fuel pump. There is a union on the pump itself, and one nearby, close to the length of flexible pipe. There is a further union on top of the tank, which can be reached through the rectangular trap-door at the rear of the luggage compartment behind the back seats. The tightness of the pump cover and drain plug should also be checked. If all is well and the pump does not operate disconnect the suction pipe from the fuel pump and alternately blow down it and suck it with the mouth to test for obstructions and leaks.

If the fault is not in the pipe remove the pump. Hold your fingers over the inlet and outlet holes and work the rocker arm quickly several times. You should be able to feel the suction and pressure on your fingers. Petrol leaking out of the vent hole

in the front of the pump body is evidence of a punctured diaphragm, which must be replaced.

Carburettor Jets. The jets fitted as standard will give the best all-round results. Increased performance, for example, can be obtained only at the sacrifice of economy, and vice versa.

The standard setting is: main jet, 85; idling, 55; progression, 100; compensator, 75; starter, 105; diptube control jet, 140. If the car is used at high altitudes, a reduction in jet size will be necessary in order to compensate for the reduced density of the air. The standard main jet should be 80 and the standard compensator 65. The other jets do not require alteration.

Excessive Fuel Consumption. In assessing petrol consumption it must be remembered that the main factors which influence it are outside the mechanism of the car. Traffic-driving with its lengthy stops with engine running, steep hills, high head winds, driving the car at a very high speed and extra load all take their toll of petrol.

Other causes are—

(1) Loose petrol-pipe connexions or other fuel leakages.

(2) Loose jets in the carburettor.

(3) Running the engine longer than is absolutely necessary with the starting device in use.

(4) Running with the hand brake partially on.

(5) Under-inflated and unevenly inflated tyres.

(6) Wheels knocked out of true or out of track by an accident.

(7) Ignition timing disturbed, or incorrect due to neglect or unskilled adjustment of the contact-breaker points.

(8) Lack of proper attention and lubrication. General loss of tune after many thousands of miles of use. It may be that the time for decarbonizing and attention to the valves has arrived. (See page 34 for symptoms of excess carbon and damaged valves.)

Carburettor Air Cleaner. As a general rule, the element should be cleaned and the oil renewed every time the engine oil is changed, although in dusty conditions it may be advisable to clean it more frequently.

Unscrew the wing nut on the top cover and remove the top and filter unit. Empty the oil and clean out the accumulated sludge from the bottom. Wash the filter unit in petrol to remove the dust and dirt; fill the air-cleaner body with fresh engine oil up to the level of the arrow. Check that the cork gaskets are in good condition and refit the filter element, so that the distance feet rest on the oil-bath shelf, then replace the cover.

CHAPTER IX

TRANSMISSION AND CHASSIS ITEMS

SOME of the information given in this chapter may be regarded as non-essential. Perhaps it is, for the car will perform very well for a long time without certain of the work being done, and when attention is eventually required a Ford dealer will carry out the various jobs expeditiously. Other work, such as attention to the wheels and tyres, must be regarded as essential.

Detecting Hub Bearing Wear. By the time the car has covered its first 1000 to 1500 miles, but not before, jack up the front axle and test the adjustment of the hub bearing by shaking the wheel. It is not unlikely that by this time the newness will have worn off the bearing surfaces and there will be quite a perceptible amount of play in the bearings.

To determine if there is excessive side play, grasp the tyre at top and bottom and attempt to rock the wheel. To avoid mistaking loose spindle bushings for loose bearings, insert a wedge between the spindle and the axle when making this test to take up any spindle bushing play. If the spindle bushings have become worn sufficiently to warrant it, they should be replaced by an authorized Ford dealer.

Adjusting and Lubricating Bearings. Prise off the hub cap (Fig. 31) with a screwdriver and remove the wheel by undoing the five nuts that hold it in position, using the wheel brace supplied in the tool kit. Lift off the wheel. AS THE REMAINDER OF THIS WORK DEMANDS ABSOLUTE CLEANLINESS spread a clean sheet of newspaper on the ground under the hub and remove any road filth that has come off the wheel on to your hands. Pull out the split pin from the end of the spindle and remove the nut. The hub, together with the brake drum, can now be pulled off. Before actually jerking the hub right off its spindle it is, however, advisable to hold one's hand over the end of the hub to catch the inner race of the taper roller bearing which would otherwise fall on to the ground. While the brake drum is out of the way put a few drops of oil on the faces of the operating wedge and on the spindles of the rollers, taking care that none falls on the brake linings.

Pack grease into the bearings and smear it along the spindle liberally, because the superfluous grease ultimately finds its way into the bearings. Do not, however, fill the hub completely or, when putting it on the spindle, some of the grease will be squeezed

out past the grease retainer and it may find its way on to the brakes. Before putting on the hub grease the outer races of the bearings which remain in the hub. Now replace the hub, the inner race of the bearing, the washer and the nut.

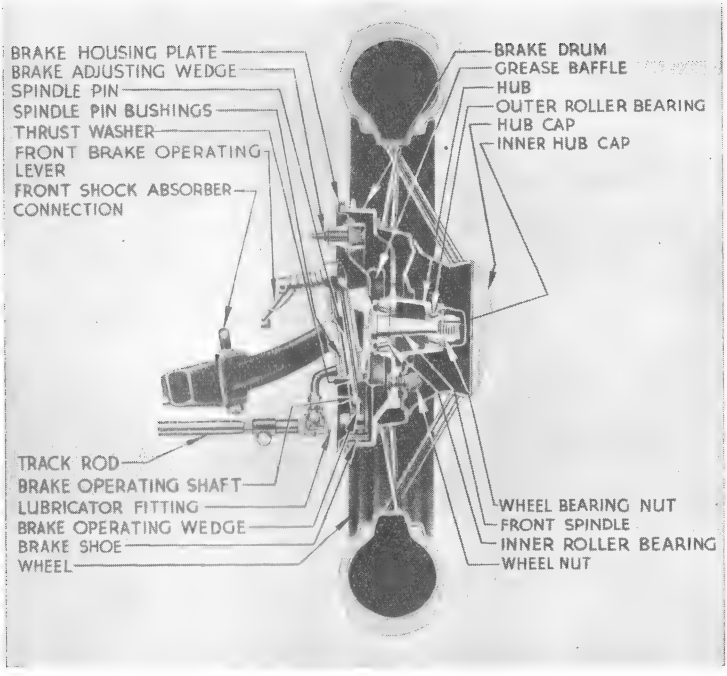


FIG. 31. DETAILS OF DE LUXE FRONT STUB AXLE ASSEMBLY

To adjust the bearings rotate the hub in the direction of motion, and, at the same time, tighten the nut. Continue to tighten until you can feel the pressure on the end of the bearings producing a decided resistance on the rotation of the wheel. Now slack off the nut approximately a quarter of a turn. Insert a NEW split pin, making sure to bend BOTH prongs over so that they lie snug against the inside of the hub-cap. As the failure of this split pin may mean the ultimate loss of a wheel, an unpleasant proceeding at high speed, always use NEW pins. A Ford dealer will sell you two of them of approved quality for a few coppers.

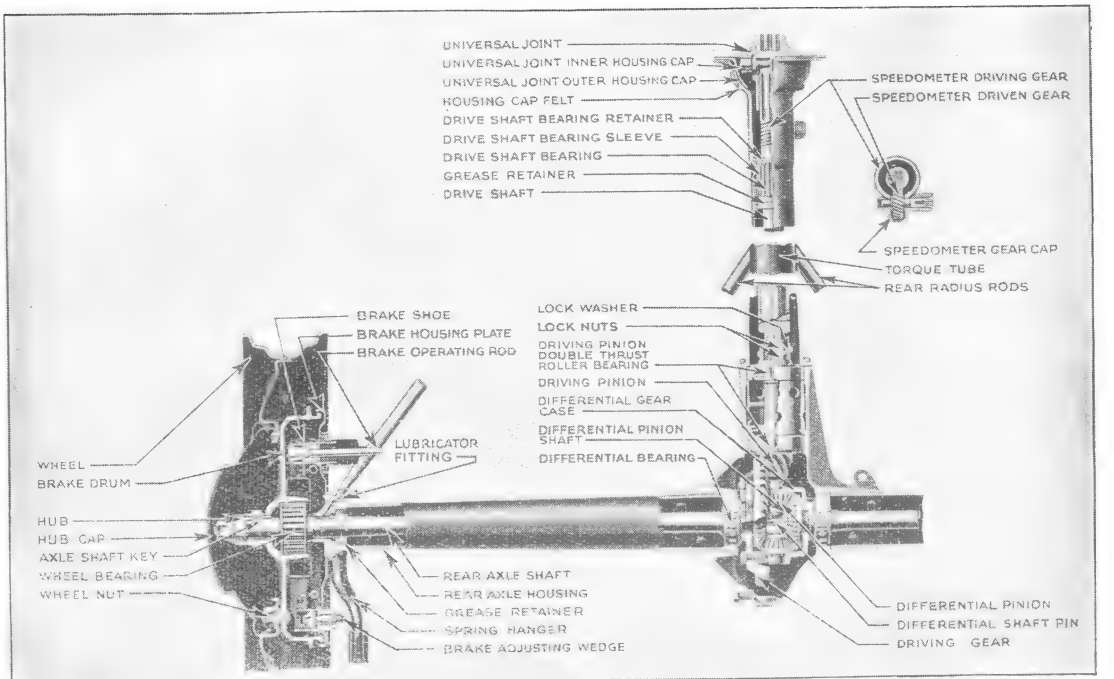


Fig. 32. Details of Rear Axle Assembly

Later models are provided with a lubricator for the drive shaft bearing half-way along the torque tube

Half fill the hub cap with grease and screw it on tightly. If this work has been done properly when the car has covered 1000 to 1500 miles it is unlikely that the hubs will require further attention for 10,000 miles, although they should be checked for bearing adjustment at 5000-mile intervals.

Rear Hubs. After the car has done its first 1000 to 1500 miles jack the back axle up and remove the rear wheel. Now remove the split pin from the rear hub nut and, with a spanner about 10 in. long, try tightening the nut up. It may not stand further tightening, but, on the other hand, it may move a small fraction of a

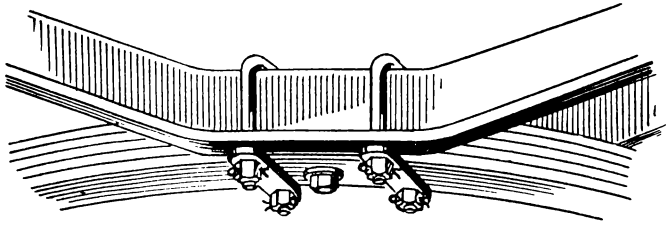


FIG. 33

The method of attaching the transverse springs to the chassis. The two U bolts clamp the spring to the chassis and the small centre bolt positions the spring leaves. The U bolts must be kept fully tightened

turn. If it comes to rest between castellations give the spanner a LIGHT TAP with a hammer to bring the split pin hole into line with the grooves in the nut. Fit a NEW split pin. It is unlikely that this job will prove to be actually necessary but it is a wise precaution, for the hub may be loosened slightly on its taper. Once this job has been undertaken it is unlikely that the rear hubs will require further attention until they have been removed for the fitting of new brake linings.

Springs. The transverse springs are each held together in their centre by a small diameter bolt and attached to the chassis by a pair of U bolts. After the car has covered its initial 1000 to 1500 miles it may be found that the nuts on the ends of the U bolts have loosened a trifle. This is because the metal in the suspension system has settled down. As a precautionary measure remove the four split pins and tighten each of the nuts not more than one-third of a turn (two castellations) at a time. When the nuts are tight fit NEW split pins and tighten up the small nut in the centre of the spring. The larger of the two double-ended spanners in the tool kit fits these nuts, which should be done up as tightly as they can with this spanner. It is unlikely that this attention will be necessary again throughout the life of the car.

Steering-gear Adjustment. The steering gear of the Ford Ten and De Luxe models requires very little in the way of adjustment. If the lubrication is thoroughly carried out and the car considerately driven, no adjustment will be necessary throughout the vehicle's life. In any case adjustment should not be necessary for

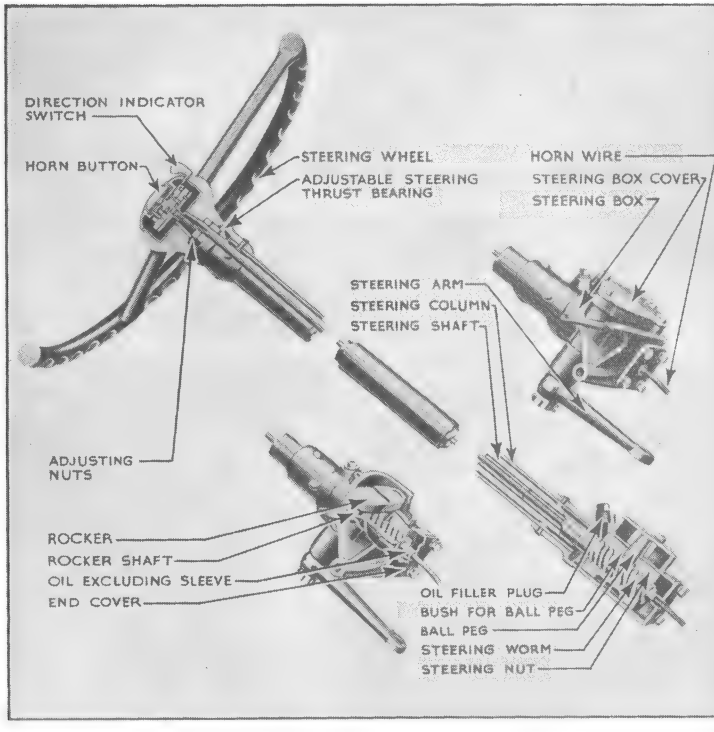


FIG. 34. STEERING GEAR DETAILS

at least 10,000 miles. If there is a considerable amount of back-lash or the wheel can be moved up and down relative to the steering column, this is evidence that the adjustable steering thrust bearing is in need of attention.

The first series of De Luxe models built at the end of 1934 and the beginning of 1935 was fitted with a special adjustment which can only be performed by a dealer who has the necessary tools.

The later De Luxe cars up to the end of 1936 were fitted with the steering gear illustrated in Fig. 34. To adjust, jack up front wheels and with a thin spanner slacken off the upper of the two adjusting nuts a turn or so. The lower nut should be tightened until drag is just perceptible with wheels raised. Holding this lower nut to prevent it rotating, tighten down the upper nut to lock it.

On the 1937 Ford Ten model the steering gear is similiar in design but the hub of the wheel covers the nuts in the interests of

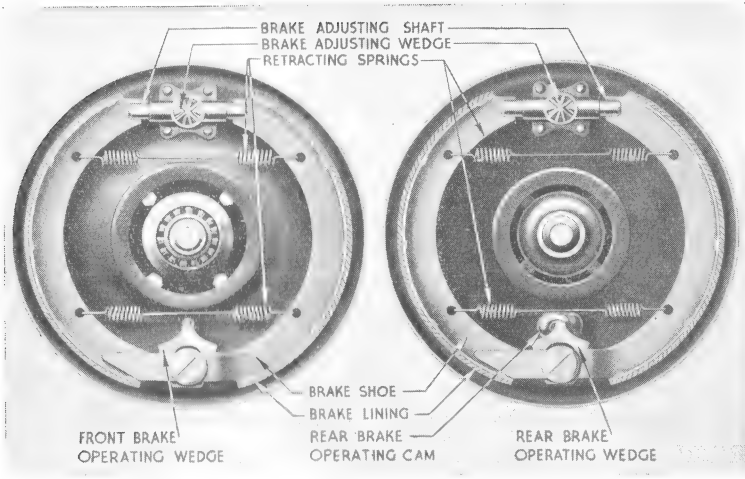


FIG. 35. SHOWING DETAILS OF BRAKE MECHANISM (DE LUXE MODELS)

neatness. It is therefore necessary to remove the steering wheel before the adjustment can be undertaken. To do this on the touring car it is only necessary to prise off the chromium-plated ring which holds the horn button in place, lift off the button, and then undo the nut which holds the steering wheel to the top of the column.

Where the direction indicator switch is located in the centre of the steering wheel, disconnect the wires running out of the bottom end of the steering box. There is a lock nut surrounding the tube that projects from the centre of the bottom of the steering box. Remove this and the indicator switch can then be pulled out, the steering wheel removed, and the steering adjusted. It will, of course, be necessary to disconnect switch wires at the connexions. After replacing the switch, take care that you centralize the

trigger at the top, and do not put too much force on the lock nut at the base of the tube, or you may shear the tube.

Adjusting and Equalizing the Brakes. The brakes of the De Luxe Ford, in common with those of many other cars, wear down fairly rapidly during the first 1000 to 1500 miles that the car has been in use, but after that the rate of wear is slow. The reason is that during the initial mileage the brake linings are bedding down to their work and, after that process is complete, they wear at their normal slow pace.

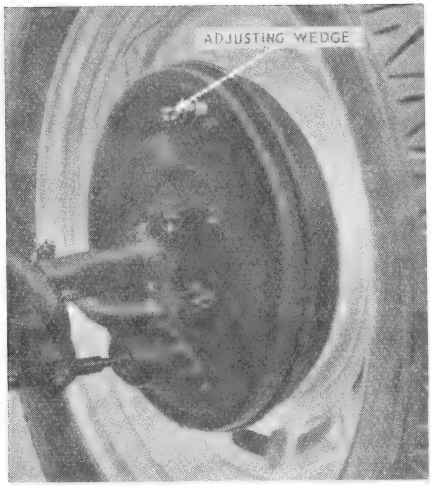


FIG. 36. BRAKE ADJUSTMENT (GIRLING)

Before adjusting the brakes (Fig. 36) make sure that the mechanism is quite free, for, if any of the joints in it are sticking or working stiffly due to lack of lubricant, the brakes will not operate with their maximum efficiency. (See page 23 under the heading "Brake and Clutch Controls" for method of oiling the clevis pins. The brake-cross shaft and brake-operating shafts should be lubricated with the grease gun.) It is also essential that all the tyres be inflated to the correct pressure, for if the tyre pressures are not correct or equalized the car will pull to one side when the brakes are applied. The brakes must be *cold* when adjusted and, for that reason, work should not be commenced on them until the car has been standing for a while. MAKE SURE THAT THE HAND-BRAKE IS COMPLETELY OFF, for the rear brake cannot otherwise be adjusted or the brakes be equalized.

Before commencing operations push the car over a flat, smooth floor in neutral gear so that you know how much force it requires to do so when it is known that the brakes are not binding. The four brakes are independently adjusted, each having its own square-headed adjusting screw on the back of the brake housing plate. Turning the screw in (i.e. right-hand thread) tightens the brakes and turning it out loosens them. THE BRAKE RODS ARE ACCURATELY SET TO LENGTH AT THE FACTORY AND THIS ADJUSTMENT SHOULD NEVER BE TAMPERED WITH.

Jack up the front axle and then turn in each adjusting screw until the brakes commence to bind. It is imperative that their drag is felt when the brake-adjusting shafts have clicked home in their notches. When this operation has been correctly performed you should be able to rotate the wheel by hand, but in so doing the drag of the brakes will be felt. When the shoes are near the drum the presence of a piece of dirt on the linings may cause an occasional scraping noise when the drum is rotated, but this should be ignored. Now slack off the adjusting screw on each front wheel exactly two notches. With the adjusters in this position the wheels should rotate freely. Repeat these operations on the rear wheels.

Push the car along a smooth, level floor and if there is evidence that the brakes are binding, which is very unlikely, slack off all brakes one notch. Take the car on a smooth, dry uncambered road. If no uncambered road is available drive down the middle of the road. When the car is travelling at about 25 miles per hour step hard on the brake pedal and bring the car to rest in the minimum distance. The length of the skid marks and the direction of the pull on the steering wheel will indicate which brake is coming on before and harder than the other three. Slack it off one notch and try again.

When the adjustment is correct the length of the skid marks will indicate, in an unmistakable manner, that all the four brakes are coming on at the same instant. One should be able to come to a standstill with all four wheels locked without the slightest sideslip or tailwag with hands off the steering wheel.

When adjusting the Girling type brakes (Fig. 36) fitted to the 1937 and later Ford Tens, it will be observed that the plate surrounding the brake actuating mechanism at the point where the brake rod enters the brake drum is attached by two screws. These have hexagon nuts split-pinned to them. Behind these nuts there are two coil spring washers. The operating mechanism is allowed to slide sideways a fraction of an inch to ensure that the brake shoes centralize themselves. To make sure that the sliding motion can take place, squirt a little penetrating oil round the edges of the small plate that surrounds the brake rod, and on the spring washers behind the nuts. This will lubricate the plate and allow it to slide as required on the brake anchor plates attached to the axle.

If the car has been neglected, remove the split-pins and nuts. Pull the plate sufficiently far away from the brake to enable a little engine oil to be squirted behind it. In replacing the nuts do not screw them up any tighter than you found them. Use new split-pins.

Ford brakes should never be re-lined but, when the lining is worn out, each shoe should be replaced by a replacement shoe

which any authorized Ford dealer will exchange for the worn shoe plus a small charge for the new linings. (There are eight shoes on the car.) This scheme, it will be found, costs no more than relining and it has the advantage of assuring that a lining is fitted that has been specially bonded for use in conjunction with the malleable iron drums fitted to this model.

Wheels. When removing the wheels prise off the hub cap with a screwdriver. It will be found advantageous to slack off each of the five nuts about one turn before jacking the car up. After jacking the wheel up spin the nuts off with the wheel brace provided in the tool-kit.

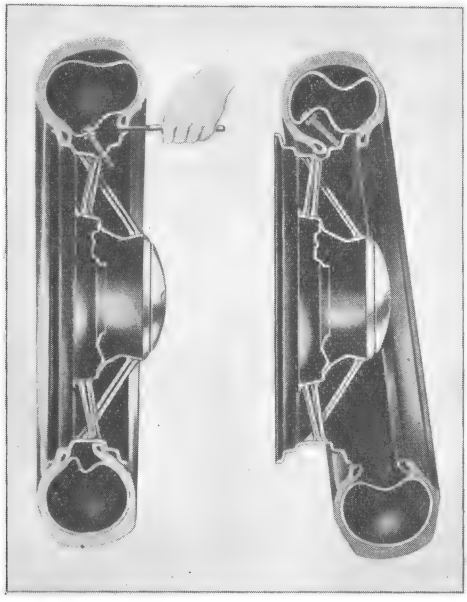


FIG. 37. REMOVING OUTER COVER

In replacing the wheel make sure that each nut is on the proper way round or it will most certainly come off before the car has run more than a few miles. The tapered face of the nut must make contact with the wheel. Each nut should be spun on only sufficiently far for it to touch the wheel and the wheel must be drawn up tight by giving each nut one turn at a time. Then follow round and tighten each nut firmly for, if they are not drawn up evenly, the wheel will not run true.

To Remove the Tyres. Deflate the tyre completely. The quickest way to do this is to take out the valve "inside." This can be unscrewed with a small tool or a valve cap that has two prongs on it designed to act as a key. The cap or tool can be purchased for a few pence. Loosen both beads from their seats in the rim and force the outside bead from the bead seat into the rim well at a point opposite the valve. This work is easiest performed by pressing the tyre inwards with the thumbs.

With two tyre levers placed approximately 4 in. on each side of the valve, lift the bead over the rim flange in the manner shown in Fig. 37. Force the inside bead into the rim well at a point remote from the valve and pull out the opposite end of the tyre until it swings clear.

To Mount the Tyre on the Wheel. Inflate the tube slightly to avoid the risk of nipping it. Some of the tyres have a red dot marked on the wall, close to the bead. When this class of tyre is used the tube must be placed in the cover with the valve at the place marked with the dot.

FIG. 38. TYRE CORRECTLY MOUNTED

Place the tyre on the wheel, guiding the valve through its hole in the rim. (The spare wheel carrier at the rear of earlier cars makes an excellent stand for this work. Fix the wheel with the valve hole near the top.) Push the bead remote from you into the rim well at a point close to the valve and then force the remaining portion over the flange of the rim nearest to you. If tyre levers are used do not attempt to force too large a portion over the flange at one time. Where the all-metal tyre valve is used, screw the valve lock nut down a few turns to prevent the valve re-entering its hole. A piece of string should be attached to the end of the rubber valve (where fitted) and tied to one of the spokes of the wheel. Place the outside beads in the rim well at the valve. Starting at each side of the valve and using both thumbs together, force short lengths of the bead over the flange of the rim, continuing round the wheel until the entire bead is in place. Always keep as much of the bead in the well as possible during this procedure, as the tyre bead is practically inextensible and, by forcing the greatest possible length into the well, the work is facilitated. Before inflating remove the valve lock nut and push the valve in a little way to make certain that the tube is not pinched under the bead. Do not, however, push the end of the valve through its hole in the rim or you may have to remove the tyre to retrieve it. Screw on the lock nut (where fitted) and pump no more than 2 lb. per square inch pressure into the tyre, working the tyre backwards and forwards to ensure

proper seating. This has been achieved when the moulded line on the wall of the tyre close to the rim is equally spaced from the rim at all points, see Fig. 38. Check the tightness of the lock nut and the valve "inside" and fully inflate the tyre.

Care of the Tyres. Unless the tyres are kept inflated at the correct pressure of 24 lb. per sq. in. for 5·00 × 16 in. tyres, or 28 lb. per sq. in. for the 4·50 × 17 in. size, they will wear rapidly.

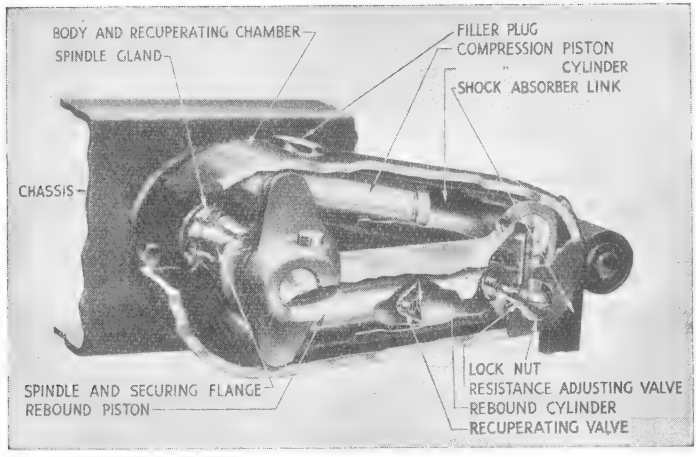


FIG. 39. PARTLY SECTIONED AND CUT-AWAY VIEW OF THE EARLIER HYDRAULIC SHOCK ABSORBER

Running the car with the tyres only partially filled is the most pernicious form of abuse, for it throws great strain on the walls.

Drivers who always get away with the accelerator hard down, corner at such a speed that the tyres squeal in protest, and whenever they come to rest apply their brakes so hard that the wheels lock and the tyres skid, take a heavy toll in rubber. Tyres abused in this fashion do not last long.

Never run on a flat tyre even for a few yards as it tears the tube, and do not run in tram lines or along their edges because, if the lines are badly worn, the edges are sharpened up to such an extent that they will cut deeply into the tyre. Bumping the side of the tyre against the curb damages it and tends to bend the wheels and knock the front wheels out of alignment. When any wheel becomes bent or runs out of true or the alignment of the front axle is deranged the rate of tyre wear is greatly accelerated.

The tyres should be examined weekly and any small stones embedded in the thread should be pulled out. If they have cut deeply into the rubber the cut should be washed out with petrol and sealed with rubber solution, which can be purchased for two or three pence from any cycle dealer. Wider gashes may be filled with one of the many preparations placed on the market for this purpose.

Earlier Type Shock Absorbers. To reach the shock absorbers (Fig. 39) it is necessary to jack the car up or run it over a pit. To adjust the shock absorbers slacken off the adjusting valve lock nut a couple of turns. Then, with the screwdriver, screw the adjusting valve down until it seats and then open it to the correct amount. This is $1\frac{1}{8}$ turns for the front shock absorbers and $1\frac{1}{8}$ turns for the rear shock absorbers. Those who habitually drive very fast may find it beneficial to run with the shock absorbers set $\frac{1}{8}$ of a turn less opening than this but on no account should the car be run with the adjusting valve much less than one complete turn open, as the hydraulic pressure builds up very rapidly at small valve openings. It will be found that alterations of adjustment of only $\frac{1}{8}$ turn make a profound difference in the suspension of the car. Always hold the valve with the screwdriver while tightening up the lock nut to prevent the valve rotating when the nut is turned.

Recent Type Shock Absorbers. On the dual-cylinder type shock absorber the fluid level should be to the bottom of the filler orifice. The design of the cover provides for normal expansion of the fluid under working conditions.

There is a cover plate to facilitate re-filling the rear shock absorbers, visible when the rear seat cushion is raised.

Do not lubricate the shock absorber links, which are rubber-bushed and designed to operate indefinitely without attention.

Grease or oil should never be added to the shock absorbers, but only the recommended fluid, obtainable from an authorized agent.

Checking Front Axle Alignment. The correct toe-in for the front wheels is $\frac{1}{16}$ to $\frac{1}{8}$ in. THE ONLY REALLY SATISFACTORY CHECK CAN BE MADE BY AN AUTHORIZED FORD DEALER WHO HAS SPECIAL GAUGES FOR THIS WORK.

The adjustment is corrected by altering the length of the track rod. The ball joint housings are screwed onto the ends of the rod. Loosen the clamping bolt on each ball joint housing and then rotate the rod until the correct amount of toe-in is attained. Do not neglect to tighten the clamping bolts and fix new split pins after interfering with the track rod adjustment.

As this is an operation calling for a high degree of skill it is in every way preferable that track rod adjustments and front wheel aligning be left to an authorized Ford dealer.

Clutch. The clutch is designed to run dry and on no account should it be lubricated. See page 26, for notes on the lubrication of the clutch release bearing.

To check the clutch adjustment pull the clutch pedal right up with the fingers and then press it down again until you can just feel the clutch release bearing coming into contact with the clutch release mechanism. Unless there is some free movement the clutch will not engage properly and the constant slipping will rapidly destroy it. The correct amount of free movement as indicated by the above test is $\frac{1}{2}$–$\frac{3}{4}$ in.

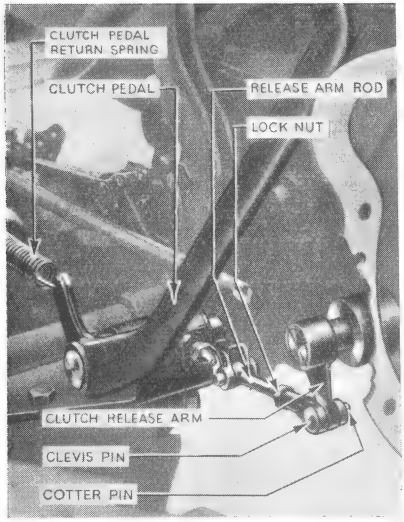


FIG. 40. CLUTCH PEDAL ADJUSTMENT

The adjustment is made by removing the cotter pin and clevis pin at the bottom of the clutch release arm (see Fig. 40) and loosening the lock nut on the release arm rod. The clevis on the front end of the release arm rod can then be screwed out towards the front of the car to increase the pedal free movement. Replace the clevis pin but, before tightening the lock nut fully or bending over the prongs of the cotter pin, check the pedal free movement. Do not forget to tighten the lock nut or bend open the prongs of the cotter pin. Oil both clevis pins and lubricate the clutch pedal shaft with the grease gun. Because of the relative movement between the rubber mounted engine and the clutch pedal it is inadvisable to run the car with less than $\frac{3}{4}$ in. free movement to the clutch pedal. When adjusting on no account give more than $1\frac{1}{8}$ in. free movement or difficulty may be found in releasing the clutch fully when gear changing.

Gearbox. Periodically check the level of the lubricant by removing the lever plug on the off side of the gearbox on earlier cars, or by means of the gearbox dipstick on later models. The gearbox holds approximately $1\frac{1}{4}$ pints of oil. The correct lubricants are given on page 32.

The easiest way to add oil is by lifting out the gear lever and

pouring the lubricant into the opening left in the top of the box when the gear lever is removed. Make sure that the gear is in neutral. Spread paper over the carpet onto which any oil on the bottom of the gear lever can drip and so avoid soiling the interior of the car. Slip up the moulded rubber trouser round the base of the gear lever. Slack back the thin locking ring under the gear-lever cap. (See Fig. 41.) The gear-lever cap can now be unscrewed with the fingers. Pour in the lubricant until it commences to run out of the hole in the off side of the gearbox that is closed by the square headed screwed plug. (This plug must, of course, be removed during this part of the filling operation.) As soon as the oil level reaches the plug hole replace the plug. If an extra half teacup of oil is now added the level will be sufficiently high to assure that the lubrication will not need any more attention for several thousand miles. More oil should not, however, be given as too much lubricant sets up a considerable drag and results in loss of power. On later cars fill to the dipstick mark.

Every 5000 miles flush the gearbox. To do this drain off the old oil and empty about ¾ pint of light flushing oil into the gearbox. Run the engine at a moderately brisk pace for three or four minutes with the gear in neutral and the clutch engaged. This will circulate the flushing oil. Empty this out and refill with gear lubricant in the manner previously indicated.

When replacing the gear lever make sure that the gear lever cap is as tight as it can be when put on with the fingers only and that the locking ring is done up tight or the gear lever will rattle.

It is important to note that, if the gearbox cover is removed at any time THE OUTER RING OF THE SYNCHRONIZER SHOULD NOT BE MOVED ON ITS INNER HUB. If this outer ring travels beyond its normal position (which is determined by the selector in the gearbox cover assembly) the six balls which locate the central position of the ring on the hub will, on account of the spring pressure exerted, fly outward with considerable force and they may become lost or cause injury to any person standing close by. In order to replace them, it will be necessary to dismantle the gearbox and special equipment will be needed to refit the balls.

Rear Axle. The rear axle should be lubricated with the same grade of oil as the gearbox. (See page 32, for recommended lubricant.) Periodically the level of the oil in the axle casing should be checked by removing the plug in the back of the central portion of the axle. This plug has a square recess in it and there is a squared end to the handle of the adjustable spanner in the tool kit which acts as a key for this plug. Fill the axle

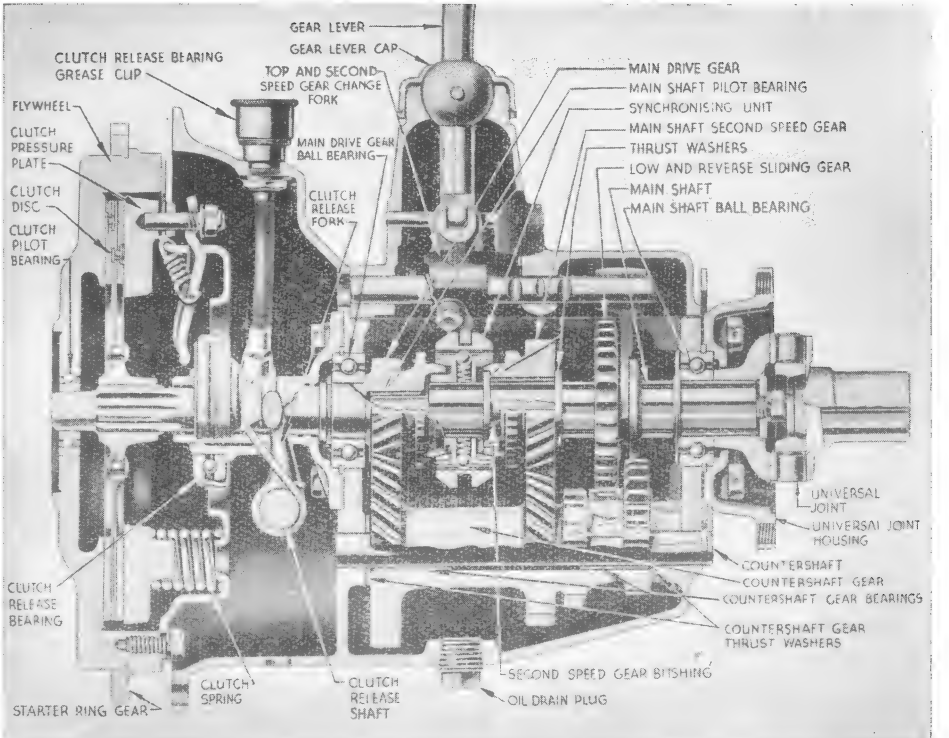


FIG. 41. SECTIONAL VIEW OF SYNCHROMESH GEARBOX AND CLUTCH (EARLY TYPE)

until the oil commences to run out of the plug hole. It holds approximately one pint.

At each end of the axle there is a wheel bearing which is lubricated by a grease gun fitting behind the brake housing plate. Give each of these bearings one pumpful of grease every 1000 miles. More should not be given as the excess may find its way on to the brakes.

Every 5000 miles drain off the old lubricant by removing the drain plug under the centre of the axle casing. Replace the plug and pour about ¾ pint of flushing oil into the axle. Jack up both rear wheels just sufficiently to clear the ground, start the engine and engage top gear. Run the engine at a tick-over speed for quarter to half a minute to circulate the flushing oil and then drain it off. Fill the axle casing with the correct grade of oil. You will find it very difficult to do this without either a funnel or an oil syringe, the latter being preferable. After filling make sure that the filler and drain plugs are tight, also check the tightness of the screws that hold the two halves of the axle casing together. Their heads are slightly recessed into the casing but they can be easily reached with the tube spanner provided in the tool kit.

CHAPTER X

CLEANING AND STORING THE CAR

BEFORE dealing with the exterior of the body, clean the inside, brushing the mats and upholstery. If a vacuum cleaner is available it will facilitate the work, especially on cloth upholstery. Wipe over the windows with a dry duster.

Washing the Car. Use cold or lukewarm water, never hot. Before commencing to hose down the car be certain that the windows, scuttle ventilator and screen are closed. Take care not to direct the hose into the bonnet louvres, radiator, or on to the windows. If you do, the water will run down the glass and some of it may find its way into the interior of the doors despite the rubber strips that are fitted to keep out rain.

It is always preferable to hose off the mud immediately the car comes in from a run when the mud is still soft. Never rub dry mud off with a duster as it scratches the cellulose. Hose it off, using a plentiful supply of water. When the worst of the mud has been softened or removed proceed to hose the car down using a fine spray and, working from the top so that no dirt runs over an already clean part. The full force of the hose must never be employed. Work with the hose in one hand and a well-wetted sponge in the other.

Oil stains may be wiped off the paint work with a small brush and some paraffin. To remove tar splashes use a mixture of $\frac{2}{3}$ petrol and $\frac{1}{3}$ engine oil. Drop a soft cloth into the mixture and, using one finger, rub the spot gently until it is removed. The rubbed spots and the parts cleaned with paraffin should be washed off with clean water. Rinse the car with a fine spray. With a clean sponge and pail of water remove the surplus water from the body and leather off with a damp but well-wrung chamois leather. Use a different leather for the wheels and axles to preserve the better leather for the coach work. When the car is perfectly dry its appearance is improved by a light final polish with a duster to remove leather marks.

The celluloid side screens fitted to the De Luxe and Ten Touring models can be brightened up by cleaning them with a brass polish such as Brasso, rubbing the preparation on in wide circular sweeps and polishing it off in the usual manner. If the hoods of these bodies become dirty they should be washed with warm, but not hot, water and a stiff brush and soap. This must be a pure soap which contains no soda, as soda may leave a permanent mark if

any of it is splashed on the paintwork. Do not fold the hood until it is thoroughly dry.

Polishing. It is not always realized that it is possible to restore a mirror finish to the coachwork by the use of an abrasive polish, usually termed a "cleaner," which removes the oxide film, followed by a hard-gloss wax polish to protect the newly-exposed surface.

Abrasive cleaners should not be used more frequently than, say, once or twice a year, owing to the fact that a small layer of the finish is removed on each occasion. Moreover they should be used with discretion on sharply curved surfaces, such as the curve of the bonnet, the window ledges and similar parts, owing to the risk of "polishing through" the cellulose.

Preserving Chromium Plating. Chromium plating must not be treated with ordinary metal polish, or the surface will soon deteriorate. All that is normally required is the application of a damp chamois leather. It will be found that with this treatment the lustre of the chromium will steadily improve. If the surface is badly tarnished, however, a special chromium polish may be used.

Storing the Car. If it is decided to store the car for the winter choose a dry garage in which the car is completely protected from the weather. Drain the radiator and, in the interests of safety, empty the petrol tank. Drain off the engine oil and put half a gallon of fresh oil in the engine. Run it for five or more minutes to splash the lubricant over all the working parts.

Inflate the tyres to 35 lb. per square inch and jack the wheels up clear of the ground. If only one jack is available the wheels can be raised by placing bricks under the axles. Any oil or grease on the tyres should be removed with petrol. Rub a thin coating of grease over any unprotected metal parts that are liable to rust. Close the windows and cover the car with a dust sheet.

If the car is being stored for more than a month have the battery recharged at monthly intervals to keep it in good condition. If possible, once a week engage top gear and crank the engine over by hand for a few seconds to distribute the lubricant over the engine and transmission working parts.

The car must never be stored in a dirty condition, as the damp in the mud encourages the formation of rust.

CHAPTER XI

FACTS AND FIGURES

In this chapter basic information of use both from the maintenance point of view and also to the intending purchaser of a new or second-hand Ten is presented in "potted" form. The details apply to all models in the range, from the earliest to later cars, although they must, in some instances, be generalized, since space does not permit a detailed list of the minor changes which have taken place from time to time. The road test and tables at the end of the chapter may also prove useful to the keen driver.

Description

As will be seen by a glance at Fig. 45, the streamlining is gracefully carried out, reducing head resistance; owing to the streamlined "tail," air is free to "flow" over the body without creating a partial vacuum at the rear. The application of scientific streamlining has resulted in bodywork of very pleasing lines.

Bodywork. With ample room for four adults, the body is of welded-steel construction and is tastefully finished in a choice of colours.

The upholstery is of durable cloth in harmony with the body colour, but leather is obtainable at extra cost. A sliding roof may also be obtained at extra cost. Fig. 42 shows the front of the car, and the wide domed mudguards should be noticed.

Rear-seat passengers enjoy far more comfort in the Ford Ten than in many big cars, and this has been made possible by the position of the seats and the exceptional body width. The seat itself is deeply cushioned and softly sprung and the position is restful and comfortable, there being plenty of head and leg room. Large side windows give rear passengers an excellent view, and with the no-draught system of ventilation the interior of the car can be kept fresh and cool in any weather without discomfort to the rear passengers.

A marked improvement in riding comfort has been obtained by designing the car so that all passengers sit *between* the axles (see Fig. 43). This ensures smoothness and steadiness at high speeds and on uneven road surfaces. A unique system of suspension further enhances the smooth-riding qualities of the car. All driving strains and braking thrusts are taken by radius rods, so that the springs function purely as springs.

No-draught Ventilation. A partial turn of the winder when the window is fully closed, causes it to slide back in its frame (see Fig. 44), leaving a slit through which the stale air in the saloon is drawn by the rush of air past the window. The system is applied to the front windows only. All windows lower, however,

FIG. 42. THE DOUBLE ENTRANCE PREFECT

and are actuated by easily-operated winders. The front windows drop flush with the window frame, a feature which will be appreciated by the driver. Another ventilation detail is the scuttle ventilator, which is opened or shut by a lever beneath the dash and enables the car to be kept cool in hot weather.

Driving Comfort. The synchronized gear change and the conveniently placed gear lever remove the terrors of traffic driving. Steering is light and the ideal weight distribution and efficient suspension make it a delightful car to handle. The brakes are powerful and demand only light pressure of the pedal to bring the car to a swift, smooth stop. Conveniently placed to the left of the clutch is the dip switch button, which is operated by the foot. Thus, it is unnecessary to move the hands from the steering

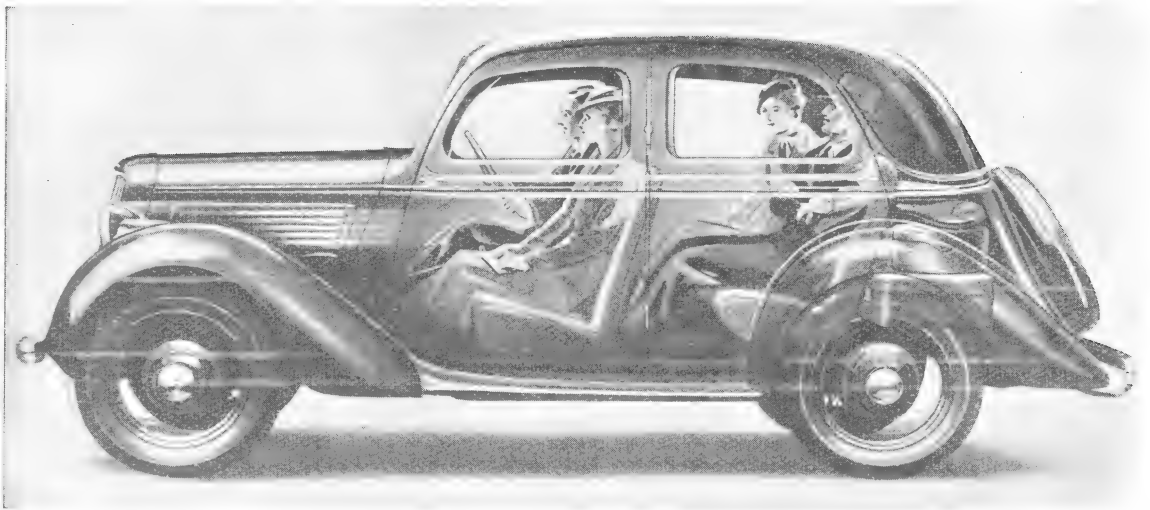


FIG. 43. SHOWING THE UNIQUE SEATING ARRANGEMENT
Note all four passengers sit *between* the axles

wheel when dipping the lights, a safety point which will have the approval of all drivers. The driving seat, which is of the semi-bucket type, can be adjusted while driving. Twin windscreen wipers are provided, and the instrument panel has indirect lighting. A rear window blind is provided and is operated from the driver's seat. The doors are exceptionally wide to provide easy access to the driving seat. The direction indicators, which

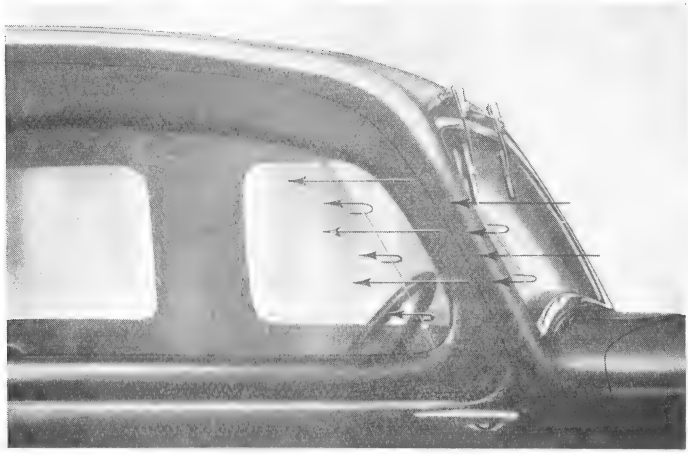


FIG. 44. SHOWING THE FORD NO-DRAUGHT SYSTEM OF VENTILATION

The rush of air past the partially-open window draws the stale air from the interior of the saloon

fit flush into the centre of the body, are operated on earlier cars by a control incorporated in the ball at the top of the gear lever. Just a turn to the right or left of the knurled ring to give the desired signal: a warning lamp glows as a reminder to lower the signal arm after completing the turn. Later models have a switch at the centre of the steering wheel. The signals are of the internally-illuminated type, giving a clear signal by day or night. The instrument panel carries a large speedometer, petrol gauge, ammeter, the starter and choke buttons, and the ignition and lighting switches (see Fig. 1). The driving mirror is placed centrally above the windscreen and incorporates a clock which can be illuminated at night.

Luggage Accommodation. The luggage locker, holding a very large amount of luggage, is in the streamlined tail and on earlier

cars is accessible from the interior of the car by raising the hinged back of the rear seat. On later Tens, however, the locker has a hinged external lid, with the spare wheel in a compartment below it. Another feature is the wide parcels shelf provided behind the rear seat.

Specification

Engine. Four cylinders cast integrally with top half of crankcase. "L" head. Bore: 2·5 in. (63·5 mm.). Stroke: 3·64 in. (92·56 mm.) Capacity: 71·55 cub. in. (1172 c.c.). Treasury and R.A.C. rating 10 h.p. Three bearing crankshaft weighing 20 lb. Total main bearing area 24·25 sq. in. Detachable cylinder head. Fabric camshaft gear. Aluminium alloy pistons. Engine timing pin fitted to cylinder front cover. Three-point suspension on rubber. Mushroom-ended valve stems.

Engine Lubrication. Full pressure feed by submerged gear pump to crankshaft main bearings, camshaft bearings, big end bearings via oil ducts cast in cylinder block and drilled crankshaft. Gudgeon pins and cylinder walls splash-lubricated. Oil sump capacity 4½ pints (recent models, 4 pints).

Ignition. Battery and coil (battery accessibly located under bonnet). Automatic advance and retard. Distributor accessibly mounted on cylinder head. Firing order: 1, 2, 4, 3.

Petrol Supply. Petrol tank at rear. Capacity 6½ Imperial gallons (29·55 litres); 7 gallons on later models. Diaphragm type fuel pump operated from camshaft. Petrol gauge on instrument panel.

Carburation. Down-draught type incorporating easy starting device.

Cooling. Thermo siphon. Two-bladed fan driven by "V" belt. Capacity 1½ Imperial gallons (6·82 litres). Water pump and four-bladed fan are available.

Transmission. Clutch: Dry single plate, spring cushioned. Release bearing: heavy duty ball thrust bearing.

Gears: Selective sliding gear—synchro-mesh. Helically cut constant mesh gears.

Lubricating oil capacity of gearbox, 1¼ pint (0·71 litre).

Synchro-mesh top and intermediate gears.

Gear Ratios. First, 16·89 to 1; second, 9·7 to 1; top, 5·5 to 1; reverse, 22·08 to 1.

Rear Axle. Ratio: 5·5 to 1. Type: Three-quarter floating with radius rod and torque tube drive. Spiral bevel drive pinion and gear. Roller bearings fitted throughout. Lubrication capacity 1 pint (0·57 litre). Special Ford design universal joint.

Front Axle. "I" beam. Castor: 8 degrees. Camber: 2 degrees. Taper roller wheel bearings.

Chassis Frame. Double drop type. Width of flange, 1½ in. (3·81 cm.). Depth, 4 in. (10·2 cm.). Length overall, 122·78 in. (3·118 metres). Three heavy cross members. Radius rods front and rear, electrically seam and butt welded.

Steering. Worm and nut type. Ratio: 10 to 1. (11 to 1 after Nov., 1949.) Steering wheel has three spokes. Turning circle: 33 ft. (10·058 metres).

Suspension. Springs: Ford Transverse design, 8 leaves front,

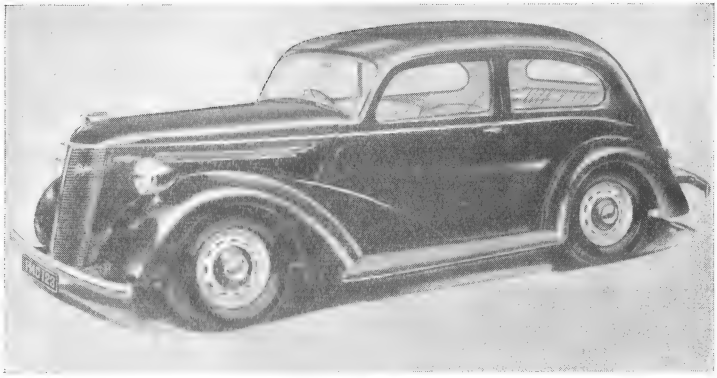


FIG. 45. THE SINGLE ENTRANCE PREFECT

(9 on recent models), 10 leaves rear Hangers steel bushed and lubricated by Tecalemit type nipples on earlier cars. Later models have greaseless-type bushes.

Shock absorbers: Double action hydraulic shock absorbers on all four wheels.

All link joints bushed with rubber.

Wheels and Tyres. Five detachable wheels. Concealed bolts. Welded steel-spoked type with well-base rims. Rustless steel hub caps. Tyres: earlier models, 4·50 in. × 17 in.; later cars, 5·00 in. × 16 in.

Brakes. Four wheel mechanical internal expanding. Foot brake on all four wheels. Hand brake on rear wheels only.

Electrical Equipment. Generator: Normal charging rate, 10 amps. on third brush type. Later cars have automatic charging control. Electric horn fitted under bonnet, operated from centre button on steering wheel.

Starter Motor: Four-pole type (two poles only wound on recent models).

Battery: Located under bonnet. 6 volt, 63 amp. hr.

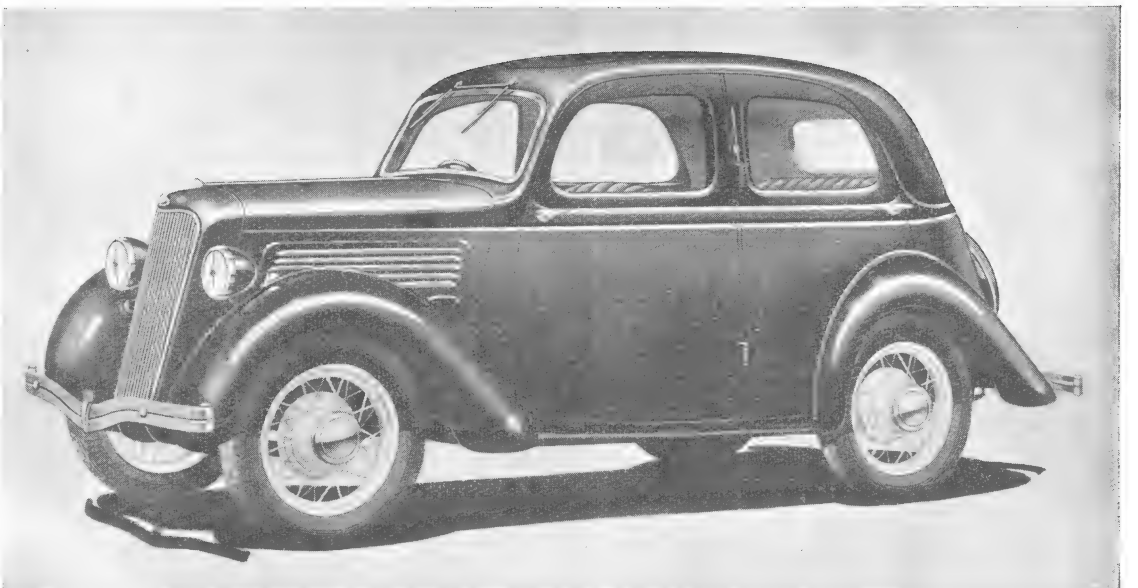


FIG. 46. THE EARLIER DOUBLE-ENTRANCE SALOON

General Dimensions (these figures are approximate, and vary on different models).

Overall length	12 ft. 1½ in.–12 ft. 11¼ in.
Overall width	4 ft. 7½ in.– 4 ft. 9 in.
Overall height .	4 ft. 3 in.
Ground clearance	approx. 8½ in.
Wheelbase	7 ft. 6 in.– 7 ft. 10 in.
Track .	45 in.
Turning circle	33 ft.

Instruments. Mounted on dashboard immediately in front of driver. Indirect lighting controlled by switch. Large diameter speedometer. Centre zero ammeter. Electric petrol gauge. Glove compartment with door on passenger's side of dash. Combined ignition and light switch fitted centre of dashboard. Starter and choke are also located in centre of dash.

USEFUL INFORMATION AND TABLES

EQUIVALENTS OF KILOMETRES IN MILES

Kilometres	Miles	Kilometres	Miles	Kilometres	Miles
0·805	½	11·265	7	80·466	50
1·609	1	12·875	8	96·558	60
3·219	2	14·484	9	112·652	70
4·828	3	16·093	10	128·744	80
6·437	4	32·186	20	144·838	90
8·047	5	48·279	30	160·931	100
9·656	6	64·372	40		

EQUIVALENTS OF FAHRENHEIT IN CENTIGRADE

Fahr.	Cent.	Fahr.	Cent.	Fahr.	Cent.
32·0	0	59·0	15	100·4	38
33·8	1	68·0	20	104·0	40
35·6	2	77·0	25	122·0	50
41·0	5	86·0	30	212·0	100
50·0	10	95·0	35		

FAULT FINDING CHART

STARTER

Fails to crank engine	Battery run down Lead disconnected or corroded Faulty starter switch Drive dirty Drive spring broken Faulty starter motor	**Cranks engine slowly**	Battery partly run down Terminal loose Connexions dirty Wrong grade of oil Faulty starter motor

ENGINE WILL NOT FIRE

IGNITION (SEE PAGE 66)

Sparking Plugs **No spark at plug gap**	Sparking-plugs oiled up Sparking-plug porcelain cracked
Distributor **No spark at plug leads**	Cracked rotor Loose low-tension leads Faulty cap Dirty or worn distributor points Faulty condenser or connexions Carbon brush not making contact
Coil **No spark at coil lead**	Coil burnt out High-tension lead loose or broken Faulty switch Points not opening or closing
Battery **No lamps light or are weak**	Battery run down Low-tension lead loose or broken

FUEL SYSTEM

No petrol in carburettor	Air leak in petrol line Blockage in carburettor pipe line Faulty petrol pump Petrol tank empty
Petrol in carburettor	Jets choked Easy starting device faulty Air leak in induction manifold Water in petrol Dirt in carburettor

Sparking Plug Test

Unscrew the plug, reconnect the lead and lay the plug on the cylinder block, watch for a spark whilst the engine is turned over by hand

SYMPTOM	PROBABLE CAUSE		
	IGNITION	CARBURETTOR	MECHANICAL
ENGINE MISFIRES	High-tension leads to sparking plugs shorting Incorrect spacing of sparking-plug points Cracked sparking-plug porcelain Battery connexions loose Faulty or damp distributor cap	Water in carburettor Petrol line partly choked Fuel pump pressure low Fuel pump filter choked Needle valve faulty or dirty	Valves sticking Valves burnt or broken Valve spring broken Incorrect valve clearance
ENGINE STARTS AND STOPS	Low-tension connexion loose Faulty switch contact Dirty contact points	Petrol line blocked Water in petrol Needle valve sticking Fuel pump faulty Petrol exhausted Air leaks	
ENGINE RUNS ON WIDE THROTTLE ONLY		Slow-running jet blocked Slow-running adjusting screw incorrectly adjusted	Valve sticking Valve burnt or broken Valve spring broken
ENGINE DOES NOT GIVE FULL POWER	Ignition retarded High-tension lead shorting Plug leads crossed Faulty distributor cap	Petrol supply faulty Air leaks in induction pipe Jets partly choked	Valve burnt or badly seated Incorrect valve clearance
ENGINE RUNS IMPERFECTLY	Timing incorrect	Carburettor flooding Weak mixture Petrol feed faulty	Inlet valve not closing
ENGINE KNOCKS	Timing too far advanced		Excessive carbon deposit Loose bearing or pistons

EQUIVALENT SPEEDS

Time for 1 Mile		Speeds	
Minutes	Seconds	Miles per Hour	Kilometres per Hour
1	0	60·00	96·51
1	5	55·43	89·10
1	10	51·42	82·73
1	15	47·99	77·21
1	20	45·00	72·40
1	25	42·36	68·14
1	30	40·00	64·36
1	35	37·89	60·96
1	40	36·00	57·92
1	45	34·29	55·16
1	50	32·73	52·65
2	0	30·00	48·26
2	20	25·71	41·36
2	40	22·50	36·20
3	0	20·00	32·18
3	20	18·00	28·96
3	30	17·14	27·58
3	40	16·36	26·32
3	50	15·60	25·18
4	0	15·00	24·13

SOME USEFUL ROAD MILEAGES (Approximate)

	Aberdeen	Birmingham	Bristol	Cambridge	Cardiff	Derby	Dover	Edinburgh	Exeter	Glasgow	Gloucester	Hull	Inverness	Lancaster	Leeds	Leicester	Lincoln	Liverpool	London	Manchester	Oxford	Penzance	Scarborough	Sheffield	Southampton
Aberdeen	—	408	491	462	499	385	580	112	540	142	456	348	105	271	322	412	386	388	509	340	520	644	312	370	516
Birmingham	408	—	85	99	101	39	181	281	156	294	52	144	459	119	107	36	88	86	110	80	62	260	158	72	125
Bristol	491	85	—	139	96	125	194	369	70	364	34	224	518	206	190	118	170	176	119	152	67	174	243	160	68
Cambridge	462	99	139	—	172	96	124	348	209	367	140	129	516	176	144	64	86	187	53	152	82	339	172	116	151
Cardiff	499	101	96	172	—	141	232	377	166	382	57	240	533	209	206	132	184	154	160	168	104	270	268	176	152
Derby	385	39	125	96	141	—	198	273	206	274	91	92	430	114	69	28	52	82	127	62	101	319	124	36	158
Dover	580	181	194	124	232	198	—	468	236	467	172	290	624	307	263	174	205	274	71	259	126	351	311	234	140
Edinburgh	112	281	369	348	377	273	468	—	439	44	334	236	156	162	208	315	264	209	397	209	393	552	200	236	457
Exeter	540	156	70	209	166	206	236	439	—	440	102	306	594	282	256	208	260	222	169	224	134	104	348	226	100
Glasgow	142	294	364	367	382	274	467	44	440	—	335	251	167	160	209	306	277	212	396	210	360	553	235	242	419
Gloucester	456	52	34	140	57	91	173	334	102	335	—	190	483	161	163	78	146	124	102	134	50	220	215	120	112
Hull	348	144	224	129	240	92	290	236	306	251	190	—	382	121	58	124	96	128	219	100	175	419	43	64	230
Inverness	105	459	518	516	533	430	624	156	594	167	483	383	—	312	365	467	442	380	553	380	521	713	357	413	584
Lancaster	271	119	206	179	209	114	307	162	282	160	161	121	312	—	67	138	139	53	236	56	184	391	126	90	248
Leeds	322	107	190	144	206	69	263	208	256	209	163	58	365	67	—	90	68	72	193	46	169	389	65	30	229
Leicester	412	36	118	64	132	28	174	315	208	306	78	124	467	138	90	—	52	119	98	84	64	312	145	60	124
Lincoln	386	88	170	86	184	52	205	264	260	277	146	96	442	139	68	52	—	110	134	92	126	378	109	44	175
Liverpool	388	86	176	187	154	82	274	209	222	212	124	128	380	53	72	119	110	—	201	35	149	326	139	72	223
London	509	110	119	53	160	127	71	397	169	396	102	219	553	236	192	98	134	201	—	188	55	278	240	162	76
Manchester	340	80	152	152	168	62	259	209	224	210	134	100	380	56	46	84	92	35	188	—	148	352	108	36	208
Oxford	520	62	67	82	104	101	126	393	134	360	50	175	521	184	169	64	126	149	55	148	—	245	232	124	64
Penzance	644	260	174	339	270	319	351	552	104	553	220	419	713	391	389	312	378	326	278	352	245	—	443	330	221
Scarborough	312	158	243	172	268	124	311	200	348	235	215	43	357	126	65	145	109	139	240	108	232	443	—	94	282
Sheffield	370	72	160	116	176	36	234	236	226	242	120	64	413	90	30	60	44	72	162	36	124	330	94	—	195
Southampton	516	125	68	151	152	158	140	457	100	419	112	230	584	248	229	124	175	223	76	208	64	221	283	195	—

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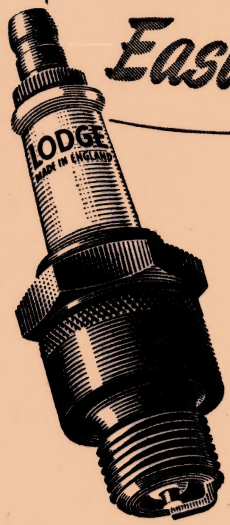

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